

DIRECTIONAL ASTROLOGY

DIRECTIONAL ASTROLOGY

TO WHICH IS ADDED A DISCUSSION OF
PROBLEMATIC POINTS AND A COM-
PLETE SET OF TABLES NECESSARY
FOR THE CALCULATION OF
ARCS OF DIRECTION

BY

SEPHARIAL

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"COSMIC SYMBOLISM," "A MANUAL OF ASTROLOGY,"
"A MANUAL OF OCCULTISM," "THE KABALA OF NUMBERS,"
"KABALISTIC ASTROLOGY," ETC.

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PREFACE

A WORD by way of introduction to this work may be necessary, inasmuch as it deals with a technical subject, and the scope and purport of it cannot very readily be apprehended by the casual reader. It is essentially a book for the astrological student. To the astronomer it is particularly informing in that it brings out the more scientific part of the subject and shows the mathematical basis underlying the "lucky hits" to which many of our astrological exponents have undisputed claim.

The general scope of this work embraces all that is essential to the art of "directing" as practised by Claudius Ptolemy and Titus de Placidus, and more recently by Sir John Wharton, Mr John Gadbury, Commander Morrison, R.N., and Mr A. J. Pearce, all of whom pursued the same general principles of astronomical directing, and differed considerably in their application of the celestial arcs to the measure of time. These points are reviewed and critically examined in the following pages.

An attempt having been made to bring the Arabian system of a day for a year into accord with the astronomical system of a degree for a year, some suggestions have here been made as to their rapprochement, the feeling being that, where credit is claimed for one system over another by exponents of either, the probability is that there is truth in both and hence there must be a co-ordinating factor. In the attempt to scientifically extend our horizon to include a prescience of coming events, we have primarily to remember that there are many ways up a mountain, but there is only one top. A study of these various methods may lead to the conclusion that they are all leading in the same direction. It is as if one should say there are three hundred and sixty paces from end to end of the path, and another should say that there are three hundred and sixty-five. Both may be right according to their count and the measure of their tread, but the actual length of the path will remain the same whatever they make of it. This pathway is that which a man has to travel from his cradle to his grave; and there is nothing that concerns a man so vitally as that he should know its trend and gradient, its pitfalls and rocky eminences, in advance of his going, so that experience may be laid by the heels and made to serve instead of to subjugate. And in the direst extreme of human experience we have to remember that "the wise man foreseeth the evil

and obscureth himself, while the ignorant pass on and are hurt."

I have used a well-known and thoroughly authenticated horoscope for purposes of illustration, and anybody following the rules here given in relation to that horoscope will have no difficulty in following them out in respect to any other horoscope. Particular care has been taken to define the principle underlying each operation, and to give a clean-cut rule of procedure. Unlike most authors, who proceed by befogging the mind of the student with technicalities and afterwards explaining them by means of an appendix, I have devoted the first chapters of my work to technical definitions which are essential to the proper understanding of the subject; and until these are clearly apprehended and understood, the student need go no further.

To save further expense and trouble, my publishers have completed my work by the insertion of a complete set of tables, which include tables of Right Ascension and Declination for every degree of the zodiac, together with the ascensional difference due to the latitudes of London, Birmingham, and Liverpool under the present obliquity of the Ecliptic; also tables of Sines and Tangents, and tables of Proportional Logarithms. These are all that are essential to the present treatise, and in themselves constitute a very valuable addition to the volume. It is, of course, presumed that the

student of "Directional Astrology" will have mastered the preliminary task of setting a horoscope for any given time and place with adequate precision, and hence that he is familiar with the use of an ephemeris. The present work is intended to replace and supersede *Prognostic Astronomy*, which is now out of print.

Beyond this I have nothing to say, save that I trust to have done my work efficiently and to have left no point on which a reader need question me. In such case the work may be regarded as complete, and so I hope it will be found.

SEPHARIAL.

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Directional Astrology

CHAPTER I

ASTRONOMICAL DEFINITIONS

THE following definitions must be fully understood by the student before the more intricate part of the system of directing is undertaken.

Longitude is of two kinds : longitude in the Orbit, and longitude in the Ecliptic. The latter is the only one recognised and used in this system. It is defined as distance from the vernal equinox, Aries 0, measured on the plane of the Ecliptic or Sun's path.

Latitude.—Celestial latitude is distance north or south of the Ecliptic.

Declination is distance north or south of the Equator. The Ecliptic lies in declination $23^{\circ} 27'$ north and south.

Right Ascension is distance from the vernal equinox measured on the plane of the Equator. Right ascension thus answers to geographical longitude in the same way as declination answers to geographical latitude.

Meridian Distance is the distance of a celestial

body from the midheaven of a place ; that is to say, from its meridian, measured in right ascension.

Semiarc of a planet is half the time it remains above or below the horizon of a place, measured in degrees of right ascension. The diurnal semiarc is half the arc in right ascension of a planet above the horizon, and nocturnal semiarc is half the time it is (measured in right ascension) below the horizon. The diurnal semiarc taken from 180° will give the nocturnal semiarc, and the nocturnal semiarc taken from 180° will give the diurnal semiarc.

Horizontal Arc is the distance in right ascension from a body to the point of its rising or setting. The semiarc less the meridian distance is always the horizontal arc.

Oblique Ascension is the right ascension of a body increased or diminished by its ascensional difference, according as its declination may be south or north. In northern latitudes the right ascension is increased for a body having south declination and decreased for a body having north declination, but the reverse of this is the case in southern latitudes.

Ascensional Difference is the time (measured in right ascension) that a body is above or below the horizon more or less than six hours. If, therefore, its semiarc is more than 90° the excess of 90° is its ascensional difference. All bodies that are not exactly on the equinox (Aries 0 or Libra 0) have ascensional difference. For a planet in south declination the ascensional difference is added to

its right ascension to get its oblique ascension, and for bodies having north declination the ascensional difference is subtracted. The reverse of this gives the oblique descension. The O.A. plus or minus 180° gives the obl. descension of the opposite point.

Pole of Latitude.—The pole of a place is the same as its latitude. The pole of a planet is measured by a circle of position or small circle parallel to the meridian of a place. The pole of the ascendant is the same as the latitude of the place, and this diminishes as we reach the meridian, where it is 0.

Direction is the process by which we bring the body of a planet to the longitude or body of another in a different part of the heavens either by its rising or setting, and this direction of one body to another, or to the place of another, is measured in right ascension; that is to say, by the number of degrees which pass under the meridian of a place in the interval. All directions are taken in the prime vertical, or circle of observation—that in which a person stands upright facing south. Having the proportional distance of a planet between the meridian and horizon, we may bring another body to the same proportional distance along its own arc until it appears to be in the same relative position as the first body. This supposes that the position and influence of a planet is indelibly located in that part of the heavens in which it was found at the moment of birth. All arcs of direction are measured in right ascension.

Significators, in this scheme, are the Midheaven, Ascendant, Sun, and Moon. These are the bodies or positions that are directed or moved in the prime vertical in order to form conjunctions, oppositions, and various aspects with other positions and bodies. They are called “significators,” from the fact that they are found to signify certain things in the life of an individual; as, the Sun signifies male relationships, the Moon female relationships, the Midheaven honour and position, credit, etc., and the Ascendant the health and general play of events in the individual sphere of life. For further elaboration of this point refer to the *Text-book of Astrology* or *The New Manual of Astrology*.

Promittors.—These are the planets Neptune, Uranus, Saturn, Jupiter, Mars, Venus, and Mercury. The Sun and Moon may also be classed as promittors when the Midheaven or Ascendant is directed to them.

Logarithms, invented by Baron Napier of Merchiston, first-class mathematician and astrologer, were designed for the purpose of simplifying calculations in spherical trigonometry. In this scheme the arc of 90° of a right sphere is made to equal 10.00000, which is called the radix. Then, having the logarithm of any arc, it may be multiplied into any other arc by simple addition of their logarithms; and, similarly, arcs may be divided by one another by subtracting one logarithm from another. Napier thus emphasises the fact that multiplication is

merely the addition of a number to itself a given number of times, while division is merely subtraction a number of times. Then by means of a proportional circle we can multiply and divide any arc by simple addition and subtraction. The complement of an arc is what it lacks of 90° , and as this is equal to the radix 10, the complement of a logarithm is what it lacks of 10. Thus the logarithm of the sine of 32° is log. sine 9.72421, which is also the log. cosine of 58° , because 58 is the complement of 32, both together making 90. The arithmetical complement of the logarithm is 0.27579, since this, added to the log. sine of 32° , makes 10.00000. Familiarity with the use of logarithms will readily establish their great value in all mathematical calculations connected with the sphere.

I may now ask the reader to take in hand an ephemeris for the current year, 1916, and turn to the 1st January, and the above definitions may then be illustrated.

Let us suppose that a birth took place at noon, Greenwich mean time, on that date in London. The ephemeris being calculated for mean noon at Greenwich, there will be no equation of time necessary. The Sun, Moon, and planets will be in the positions indicated in the ephemeris. The Sun's longitude is seen to be Capricornus $9^\circ 45' 14''$. The Sun never has latitude, inasmuch as it defines the Ecliptic, distance above or below which constitutes celestial latitude. All other bodies have

latitude except when they are on that point where their orbits cross the Ecliptic, that is, their nodes. The course of the Sun being across the plane of the Equator at an angle of $23^{\circ} 27'$ it will attain that declination at the solstices; that is to say, on the 21st June and the 22nd December. On the 1st January it is found to have declination $23^{\circ} 6'$ south of the Equator, and, therefore, would be immediately overhead at noon at a place which had geographical latitude $23^{\circ} 6'$ south, and the Sun's diurnal course around the Earth would follow this parallel of latitude. The Sun's right ascension (R.A.) can be found in the tables (see Appendix) from its longitude.

Rule 1.—To find the R.A. of any body without latitude.

From the log. cosine of its distance from the nearest equinox subtract the log. cosine of its declination. Remainder is the log. cosine of its R.A. from the same equinox.

Example : The Sun is here $80^{\circ} 15'$

| | |
|------------------------------------|--------------|
| from Aries 0 . . . | cos. 9.22878 |
| Its declination is $23^{\circ} 6'$ | cos. 9.96370 |

| | |
|----------------------------|--------------|
| Distance in R.A. from | |
| Aries 0 = $79^{\circ} 23'$ | cos. 9.26508 |

Therefore from 360° take $79^{\circ} 23'$, and the R.A. of the Sun is thus found to be $280^{\circ} 37'$. Note that it is sufficient for our purpose to take the various quantities to the nearest minute of space.

Now take the Moon's place in the ephemeris, which is seen to be Scorpio $17^{\circ} 54'$. This is $47^{\circ} 54'$ from Libra 0. The declination of the Moon is $22^{\circ} 7'$. Reference to the tables will show that the declination of Scorpio $17^{\circ} 54'$ is $17^{\circ} 10'$ only, and we therefore know that the Moon has latitude and is not on the Ecliptic at this time. The ephemeris shows it to have $5^{\circ} 9'$ of south latitude. In finding its R.A., therefore, we have to take this latitude into account.

Rule 2.—To find the R.A. of a body having latitude.

Add the log. cos. of its distance from the equinox to the log. cos. of its latitude, and from the sum subtract the log. cos. of its declination. The remainder is log. cos. of its R.A. from the same equinox.

| | | | |
|-------------------------|--------------------------------|----------------------|--------------|
| <i>Example :</i> | | Moon's distance from | |
| | Libra 0 = $47^{\circ} 54'$ | . | cos. 9.82635 |
| | Its latitude is $5^{\circ} 9'$ | . | cos. 9.99824 |
| | | | <hr/> |
| | Sum | . | cos. 9.82459 |
| | Moon's declination, | | |
| | $22^{\circ} 7'$ | . | cos. 9.96681 |
| | | | <hr/> |
| Its R.A. from Libra 0 = | $43^{\circ} 53'$ | | cos. 9.85778 |
| R.A. Libra 0 | = $180^{\circ} 0'$ | | |
| | | | <hr/> |
| Moon's R.A. | = $223^{\circ} 53'$ | | |

Note.—If we take the arithmetical complement of the log. cos. of the declination and add it to the log. cos. of both the latitude and the longitudinal distance, we shall have the same result.

The R.A. of the other bodies is taken in the same manner, as they all happen to have some measure of latitude. Only when a body is in its node, and therefore coincident with the Ecliptic, does it have no latitude. In such case its R.A. is the same as that of the degree of the Ecliptic it holds.

We have next to find the meridian distances of the several bodies. To do this we have to find the R.A. of the Midheaven and Nadir, and take the nearest distance in R.A. of each body. Thus at noon on the 1st January 1916 the sidereal time is 18h. 39m. 16 secs. Convert this into degrees and minutes of the circle, thus : multiply the hours by 15 and call them degrees ; divide the minutes of time by 4 and call them degrees and minutes of space ; also divide the seconds of time by 4 and call them minutes and seconds of space.

$$\begin{array}{rcl} \text{Thus 18h.} & = & 270^{\circ} \ 0' \ 0'' \\ 39\text{m.} & = & 9^{\circ} \ 45' \ 0'' \\ 16\text{s.} & = & 0^{\circ} \ 4' \ 0'' \end{array}$$

$$\begin{array}{rcl} \text{R.A. of M.C.} & = & 279^{\circ} \ 49' \ 0'' \\ & & 180^{\circ} \ 0' \ 0'' \end{array}$$

$$\text{R.A. of I.C.} = 99^{\circ} \ 49' \ 0''$$

The upper meridian is called the Midheaven

(*medium cœli*) and the lower meridian is called the Nadir (*imaum cœli*).

Having the R.A. of the M.C. and I.C., we are able to find the quantity of R.A. which separates the various planets from them, and this is the meridian distance of each of such planets.

Thus the Sun's R.A. was found to be $280^{\circ} 37'$, and that of the M.C. (to which it is nearest) is $279^{\circ} 49'$. The difference is $0^{\circ} 48'$, which is therefore the meridian distance of the Sun.

The Moon is found to be in the South-west quarter of the heavens, and therefore nearer to the upper than the lower meridian. Its meridian distance must therefore be taken from this point. Thus :

| | |
|--------------|---------------------|
| R.A. of M.C. | $= 279^{\circ} 49'$ |
| R.A., Moon | $= 223^{\circ} 53'$ |

$$\text{Meridian distance of Moon} = 55^{\circ} 56'$$

The other bodies are taken in the same way according to which meridian (upper or lower) they are nearest in R.A.

The semi-arcs of the planets and luminaries have next to be found.

Rule 3.—To the log. tangent of the latitude of place for which the figure is set, or the horoscope cast, add the log. tangent of the planet's declination. The sum is the log. sine of the ascensional difference of that planet under the latitude of birth.

Uniformly, add this ascensional difference to 90° when the planet's R.A. is less than 180° , and subtract it from 90° if the planet's R.A. is more than 180° . The result is the diurnal semiarc of that planet. By subtracting this from 180° you will have the nocturnal semiarc.

Finally, by taking the meridian distance of the planet from its semiarc (diurnal if above the horizon, and nocturnal if below), you will have the horizontal arc, or distance in R.A. from the horizon.

Next find the proportional logarithm of the semiarc of each body, and take its arithmetical complement. Add to this A.C. the proportional logarithm of the planet's meridian distance. This is the constant log. of the planet for purposes of directing.

Enter all these elements into a single table, which is called the Speculum, an example of which will be found in the following pages. The scheme will now be ready for the practice of directing.

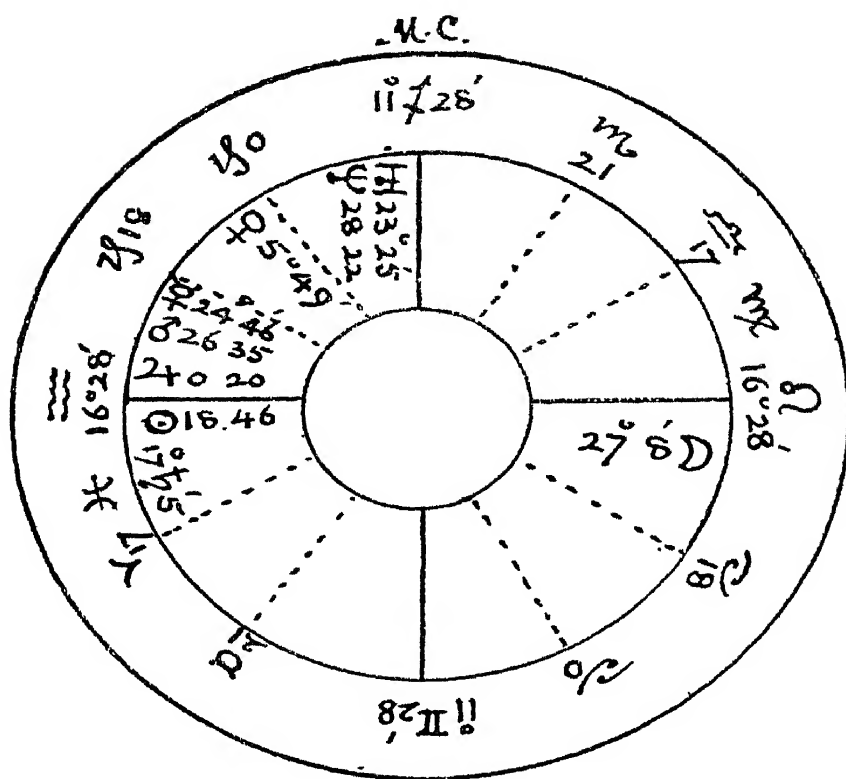
CHAPTER II

EXAMPLE HOROSCOPE

FOR the purpose of illustrating the method of directing by proportional semiarc, I have selected the horoscope of John Ruskin, whose *Fors Clavigera*, *Mornings in Florence*, and other world-renowned works have stamped him indelibly as artist and man of letters as well as an independent thinker of considerable virility.

He was born at 7.30 in the morning of 8th February 1819, in London.

It is an invariable rule in practice to use that semiarc and meridian distance which are related to one another. Thus the Sun in the speculum is just below the east horizon at the moment of birth, as may be seen by comparing its nocturnal semiarc with its distance from the lower meridian, which are $110^{\circ} 1'$ and $108^{\circ} 44'$ respectively. This shows the Sun to be $1^{\circ} 17'$ below the horizon. But as by the diurnal rotation of the earth on its axis from west to east the Sun will be carried above the east horizon upwards towards the Midheaven, during the course of which it will pass the places



SPECULUM.

| Planets. | Lat. | Declin. | R.A. | Merid. Dist. | Semi-arc. | Hor. Arc. |
|---------------|-----------|------------|----------|--------------|-----------|-----------|
| Sun . . . | ° — | 15° 13' S. | 321° 12' | 108° 44' | 110° 1' | 1° 17' |
| Moon . . . | 5° 1' N. | 25° 39' N. | 120° 17' | 50° 21' | 52° 51' | 2° 30' |
| Mercury . . . | 0° 23' S. | 21° 34' S. | 296° 47' | 46° 51' | 60° 11' | 13° 20' |
| Venus . . . | 5° 10' N. | 18° 10' S. | 276° 6' | 26° 10' | 65° 37' | 39° 27' |
| Mars . . . | 0° 55' S. | 21° 45' S. | 299° 6' | 49° 10' | 59° 53' | 10° 43' |
| Jupiter . . . | 0° 21' S. | 20° 26' S. | 302° 37' | 52° 41' | 62° 3' | 9° 22' |
| Saturn . . . | 1° 56' S. | 6° 54' S. | 348° 54' | 81° 2' | 98° 45' | 17° 43' |
| Uranus . . . | 0° 6' S. | 23° 24' S. | 262° 49' | 12° 53' | 57° 1' | 44° 8' |
| Neptune . . . | 1° 13' N. | 22° 14' S. | 267° 47' | 17° 51' | 59° 5' | 41° 14' |

of Mars, Mercury, Venus, Neptune, and Uranus, it will be convenient also to have the semidiurnal arc and the meridian distance from the Midheaven. For whenever we use the nocturnal arc we always use the corresponding meridian distance from the lower meridian, and whenever we use the diurnal arc we also use the corresponding meridian distance from the Midheaven or upper meridian. This point should not be forgotten. It cannot be overlooked if the constant log. of the planet is inserted in the speculum, because this embodies the proportion of the semiarc to the corresponding meridian distance.

Ruskin was agreeably disposed towards the idea of planetary influence in human life, for, although he confessed entire ignorance of the subject himself, he was always willing that others should have the full benefit of his experience and views, and he readily gave his birth data to those who sought it for the purpose of astrological calculations. His assertion that "there is more in it than is generally supposed" was doubtless the opinion he formed of the science from experience; and if it does not carry the weight of scientific criticism, it stamps Ruskin, at all events, as a man of fearless integrity of thought.

In this horoscope we have a remarkable illustration of the principles of astrology. The Sun and Jupiter are rising in the humane sign Aquarius, while most of the planets are rising and above the

horizon. These are indications of success and distinction in the world. The conjunction of Mars and Mercury in opposition to the Moon indicated that asperity and outspokenness which characterised this man of genius and rendered him fearless in the expression of his views. His eccentricities may well be attributed to the meridian position of Uranus and Neptune, while Venus, in closest aspect to Jupiter, and well elevated, disposed to success in the pursuit of art, of which he became a foremost exponent. But, of course, these positions do not make character. They only afford the opportunity for its full expression. Character and environment together constitute destiny, and it is undoubtedly often the case that one or the other of them is a misfit. It is only when we get a strong innate character with appropriate celestial environment that we look for the expression of genius.

We may now proceed to use this horoscope to illustrate the principles of directing.

Take first the Midheaven. This is directed by right ascension, and the planets coming to the meridian will form arcs of direction to it. The aspects to Midheaven should be noted. Thus the semisquare aspect falls in Capricorn $26^{\circ} 28'$, and the sextile aspect is Aquarius $11^{\circ} 28'$, and planets coming to these points will form aspects in the zodiac to the Midheaven. The square aspect falls in Pisces $11^{\circ} 28'$; and as Saturn is lower in the heavens than that point, it must come up to the

place of this aspect and form the zodiacal square to the Midheaven. And the times in which these aspects are formed by the several planets will be in the proportion of their semiarcs. These directions are in zodiac.

The other kind of direction is in mundo—that is, in the circle of observation or prime vertical. Thus a body that is on the cusp of the twelfth house is in mundane sextile to the Midheaven or upper meridian, and one that is on the cusp of the eleventh house is in mundane sextile to the horizon or Ascendant. A planet that is in the middle of the eleventh house will be half way between the Midheaven and Ascendant, and, therefore, in semisquare aspect in mundo, because the meridian and horizon are always at right angles to one another. If a planet is not thus situated at the moment of birth it will afterwards attain that position, and the number of equatorial degrees which pass under the meridian from birth to the time when the aspect is formed will be the measure of the arc of direction. The original position of a body, either in the zodiac or in mundo, is always that to which direction is made.

Mundane Directions are those that are made to the apparent place of a celestial body, or to its aspects, in the circle of observation.

Zodiacal Directions are those which are made to the geocentric longitude of a body, or to aspects of that longitude, in the circle of observation or prime vertical.

All directions are formed by the rotation of the Earth upon its axis from west to east, by which the planets appear to rise, culminate, and set, pursuing a course that is from east to west. The lines or arcs traversed by the planets in this apparent motion are parallels of latitude of the same quantity and denomination as geographical parallels of latitude—that is, lines parallel to the Equator. The planets follow the parallel of declination in which they are found at the time of birth.

It is understood that the radical imprint of a planet is localised in that part of the heavens it occupied at the moment of birth ; and although the actual planets do thereafter change their declinations and semi-arcs, as well as their meridian distances, the radical imprint of the planet remains ever the same, and is to be regarded as entirely distinct from the planet itself, which, of course, moves along its arc in the heavens.

In the process of directing we are, therefore, only concerned with the radix or root horoscope and the changes which thereafter take place in the heavens, not among the bodies themselves, but in their relations to the radix. All directions of this nature are formed within a few hours of the moment of birth.

Directions (whether in the zodiac or mundo) are of two orders. These are “direct” and “converse.”

Direct directions are such as are formed by one

body being carried by the motion of the Earth towards another body or aspect in the heavens that precedes it. Converse directions, however, are such as are formed in the opposite direction. Thus in the foregoing horoscope of Ruskin, if we bring the Sun to the place of Jupiter, or Mars, or Mercury, or Venus, these would be direct directions, because that is the direct motion of the bodies in the heavens. But if we brought the Sun to the place of Saturn it would appear that we are carrying it backwards to a position that it held previous to the moment of birth. This, however, is not the case. The Sun is joined to the Earth by a direct ray which is called its earth-line, and it is this line which, by the rotation of the Earth on its axis, is carried down (bearing the solar imprint) to the place held by Saturn at the birth. This is a converse direction. But if we bring Saturn up to the place of the Sun it would be a direct direction.

Therefore all directions are formed by the one natural fact of the Earth's rotation on its axis, and aspects that cannot thus be formed are not within the category of primary directions.

We may now pass on to illustrate the method of forming every kind of direction, direct and converse, in zodiac and mundo.

CHAPTER III

DIRECTIONS IN MUNDO

THE principle involved in this process is that which enters into the construction of the horoscope, wherein we take one-third of the Sun's tropical semiarc as the extent of the house or division of the prime vertical. This principle enters into the construction of the tables of houses for various latitudes, the Sun's extreme declination remaining a constant quantity.

But in every horoscope we have the various planets with different declinations, and therefore with different semiarcs; and consequently we are dealing with arcs which, although parallel to the Equator and to one another, are not parallel to the circle of observation. Hence an equal division of the prime vertical into twelve parts or houses will not effect an equal division of the various planetary semiarcs, which cut the meridian and horizon at varying angles depending on their declinations. Nevertheless, it has been found in practice that one-third of the semiarc, great or small, is equal to a house-space under the pole of that planet.

Suppose a planet to be exactly rising at the time of birth. Let its semidiurnal arc be $66^{\circ} 21'$. This is an arc of right ascension. Therefore when it has traversed one-third of its arc from the horizon to the meridian, $22^{\circ} 7'$ will have passed under the meridian, and that will be the arc of the planet's direction to the cusp of the twelfth house. Another $22^{\circ} 7'$ will bring it to the cusp of the eleventh house, and yet another arc of the same value will bring it to the meridian. When on the cusp of the twelfth house it will be in sextile aspect to the Midheaven, and when on the cusp of the eleventh it will be in sextile to the Ascendant, both directions being *in mundo*, as distinguished from similar aspects in the zodiac.

If the Sun or Moon happen to be exactly on the cusp of a house, then the planet coming to the cusp by one-third divisions of its semiarcs will simultaneously form aspects in mundo to the Sun or Moon. But if they are not so placed, then we have to find their proportional distances from the nearest cusp or limit of a house, and bring the planet to the same proportional distance in order to form the aspect.

Rule.—To find the cuspal distance of a planet. Note the cusp to which it is nearest at the time of birth. The distance of that cusp from the horizon compared with the planet's horizontal arc will give the planet's cuspal distance.

Example.—In the specimen figure the Sun is

nearest to the cusp of the first house or ascendant, and therefore its horizontal arc, $1^{\circ} 17'$, will be its cuspal distance. The Moon has a semiarc of $52^{\circ} 51'$, and its horizontal arc is $2^{\circ} 30'$, and as this is nearest to the cusp of the seventh house, that will also be its cuspal distance.

Now, as in all directions, the body to which direction is made is considered to remain stationary while the body directed is moved towards it by its natural motion in the heavens, we here direct the Moon to the sesquiquadrate aspect of the Sun, which it attains in the middle of the fifth house, that point being four and a half houses, or 135° , from the ascendant. The Sun, however, is not on the ascendant, and therefore we have to bring the Moon to a proportional distance from the middle of the fifth house. Thus :

| | |
|---|---------|
| As the semiarc of the Sun, $110^{\circ} 1'$, | |
| prop. log. | 0.21381 |
| arith. comp. | 9.78619 |
| Is to its cuspal distance, $1^{\circ} 17'$, | 2.14693 |
| So is the semiarc of Moon, $52^{\circ} 51'$, | 0.53223 |
| To its proportional distance, $0^{\circ} 37'$, | |
| prop. log. | 2.46535 |

Now, as one-third of the Moon's semiarc is $17^{\circ} 37'$, that will be its house-space, and one-half will be $8^{\circ} 48\frac{1}{2}'$, making for one and a half houses $26^{\circ} 25\frac{1}{2}'$, and from this we subtract the above proportional

distance, namely $0^{\circ} 37'$, and there remains the arc of direction: Moon, 135° , Sun in mundo, $25^{\circ} 48\frac{1}{2}'$.

Another example: Bring the Sun in the example horoscope to the mundane conjunction with Jupiter.

In order to effect this the Sun has to cross the horizon, its distance from which has been found to be $1^{\circ} 17'$. Thereafter we employ its diurnal arc and bring it to an equivalent distance from the horizon southwards as Jupiter is in the horoscope, by proportion of their semidiurnal arcs.

Jupiter's semiarc is $62^{\circ} 3'$, and its meridian distance $52^{\circ} 41'$, their difference $9^{\circ} 22'$, which is the horizontal arc of Jupiter and therefore its distance from the cusp of the first house. Then we say:—

As the semiarc Jupiter (arith. comp.) is to its cuspal distance, so is the semiarc of the Sun (diurnal = $69^{\circ} 59'$) to its proportional distance from the same cusp southwards. This works out as follows:—

| | | |
|---|--------------|--------------|
| S.A. Jupiter, $62^{\circ} 3'$ | . . . | log. 0.46253 |
| | Arith. comp. | 9.53747 |
| Cusp. distance, $9^{\circ} 22'$ | . . | 1.28369 |
| S.A. Sun, $69^{\circ} 59'$ | . . | 0.41028 |
| Sun's prop. distance = $10^{\circ} 34'$ | | log. 1.23144 |
| Sun to horizon = $1^{\circ} 17'$ | | |
| Arc of direction = $11^{\circ} 51'$ | | |
| Sun conj. Jupiter <i>m.</i> | | |

It should be observed that the arc of direction to the horizon must always be added when the planet or body has to cross the horizon in forming the direction. Here the proportion of the Sun's arc to that of Jupiter gives a cuspal distance of $10^{\circ} 34'$, and to this has to be added the distance of the Sun from below the horizon, making the arc altogether $11^{\circ} 51'$. When crossing the meridian to form a direction, no change of arc is necessary, but the arc to the meridian, which is the meridian distance of the planet, must be added to the arc formed on the other side of it.

It should be observed also that the body to which direction is made, and which is supposed to be stationary, supplies the first and second terms of the proportion, while that body which moves to form the direction supplies the third term and the resulting fourth term. In practice it will be found expedient to arrange all the mundane aspects in the order in which they are formed by each of the planets. The Midheaven and Ascendant remain stationary, and the Sun, Moon, and planets are the promissors that are moved to form directions upon them. Take one of these bodies at a time and make a list of the mundane directions it forms to the Midheaven, Ascendant, Sun, and Moon, calculate them, and arrange them afterwards in the order of their values. Always remember that the diurnal motion of the Earth upon its axis from west to east is the underlying cause of all

directions, and that the planet to which direction is made, remains still, while the other moves towards it. You cannot then go wrong in your application of the method.

Direction to the conjunction in mundo is effected by bringing the body of a planet to the body of another, and not to its zodiacal longitude merely, as is done in the case of the zodiacal conjunction.

Thus in the case of Uranus to conjunction M.C. in mundo, we take its meridian distance as the arc of direction, whereas in the zodiac we take the meridian distance of its longitude, Sagittarius $23^{\circ} 25'$, and this will be the arc of direction.

In all cases we bring the *body* of the planet directed to the conjunction or aspect of another body in mundo, to form mundane directions, all such directions being formed in the prime vertical, and expressed in terms of right ascension.

It will be found convenient to have the constant log. of the cuspal distance of each planet in the speculum. Subtract the proportional log. of the semiarc from the proportional log. of the cuspal distance. This will give the constant log., to which we have merely to add the proportional log. of the semiarc of any other planet to find the proportional cuspal distance of that planet.

It has been customary to regard the semiarc of a planet as equal to the quadrant, and therefore one-third as equal to a house or 30° . This is true in regard to a prime vertical whose pole is the

same as the declination of the planet, but it is not true in regard to any other pole or geographical latitude. That is why we take the proportion of the semiarc in finding the cuspal distances of planets. The test is this: If we take the oblique ascension of a planet, that is, exactly one-third of its semiarc from the horizon, it should have the same oblique ascension as the cusp of the twelfth house, but by adding 60 to the right ascension of the Mid-heaven to get the oblique ascension of that house, we shall find that if the planet has any other declination than $23^{\circ} 27'$ there is a difference between the two results. It cannot, therefore, be truly said that a planet is in mundane sextile aspect to the Mid-heaven when it is one-third of its semiarc above the horizon, inasmuch as its position in the prime vertical does not then coincide with the cusp of the twelfth house; but it may be said to correspond with that cusp on the general proposition that all circles are equal to one another and therefore that all quadrants are equal, and in practice it is found that one-third of a semiarc corresponds with one-third of the prime vertical, and this was allowed by Placidus, who was the first exponent of this system of mundane directions.

CHAPTER IV

DIRECTIONS IN THE ZODIAC

THESE are calculated on the same principle as mundane directions, that is to say, by proportion of the semi-arcs; but instead of taking the actual body of the planet, or its position in the prime vertical, we take the longitude only and direct to that, and also to its aspects in the zodiac.

Thus in the horoscope of Ruskin the planet Neptune holds the longitude Sagittarius $28^{\circ} 22'$, and therefore its zodiacal sextiles will fall in Aquarius $28^{\circ} 22'$ and Libra $28^{\circ} 22'$, its squares in Pisces $28^{\circ} 22'$ and Virgo $28^{\circ} 22'$, and so on.

The longitude of the planet, or its aspect if we are directing to it, remains stationary, and the actual body of the planet or luminary which is directed to it is moved along its own semiarc until it reaches the longitude or aspect to which direction is made.

Therefore we take the meridian distance and semiarc of the ecliptic degree held by a planet and use these as the first and second terms of a proportion, in which the semiarc of the body directed forms the third term.

Example.—Direct the Sun to a conjunction with Jupiter in the zodiac.

Jupiter's longitude is Aquarius $0^{\circ} 20'$, and from the tables we find this longitude to have R.A. $302^{\circ} 31'$, from which take the R.A. of Midheaven, $249^{\circ} 56'$, and we get its meridian distance, $52^{\circ} 35'$.

The same tables give the ascensional difference under London as $30^{\circ} 51'$, which, taken from 90° as the declination is south, gives the diurnal semi-arc $= 59^{\circ} 9'$.

| | | | |
|---------------------------|---|------------------|------------|
| Prop. log. meridian dist. | . | $52^{\circ} 35'$ | $= .53442$ |
| „ semiarc | . | $59^{\circ} 9'$ | $= .48332$ |

| | | | |
|--------------------------|---|------------------|------------|
| Constant log. Aquarius | . | $0^{\circ} 20'$ | $= .05110$ |
| Prop. log. Sun's semiarc | . | $69^{\circ} 59'$ | $= .41028$ |

| | | | |
|------------------------------|--|------------------|------------|
| „ Sun's prop. dist. | | $62^{\circ} 13'$ | $= .46138$ |
| Take from Sun's merid. dist. | | $71^{\circ} 16'$ | |

| | | | |
|------------------|---|--|----------------|
| Arc of direction | . | | $9^{\circ} 3'$ |
|------------------|---|--|----------------|

The constant logarithm of a longitude, once obtained, should be reserved, as it will serve for all zodiacal directions made to the same point of the ecliptic by simply adding the log. semiarc of the body directed to it. We then have the proportional meridian distance, which, compared with its original distance, gives the arc of direction.

Uniformly, find the R.A. of the longitude to which direction is made; from this derive the meridian distance. Find its declination, and from

this derive the semiarc. Subtract the proportional logarithm of the semiarc from that of the meridian distance, and derive the constant log. of the given longitude. To this constant log. add the log. semiarc of the body directed to it, and thus obtain the proportional distance of that body from the meridian at the point of direction. The difference between this and its radical meridian distance is the arc of direction.

Examples:—

1. Direct the Sun to aspects of the Midheaven in the zodiac. The aspects to which the Sun applies are the sextile in Aquarius $11^{\circ} 28'$, the semisquare in Capricorn $26^{\circ} 28'$, and the conjunction in Sagittarius $11^{\circ} 28'$.

Aquarius $11^{\circ} 28'$ has R.A. $313^{\circ} 55'$

The Midheaven has R.A. $249^{\circ} 56'$

Merid. dist. of aspect = $63^{\circ} 59'$ prop. log. .44921

Asc. diff. $23^{\circ} 9'$

$90^{\circ} 0'$

Semiarc $66^{\circ} 51'$

prop. log. .43017

Constant log. of aspect in Aquarius $11^{\circ} 28' = .01904$

Add prop. log. Sun's semiarc diurnal .41028

Sun's prop. dist. from M.C. $66^{\circ} 59'$.42932

Radical dist. of Sun from M.C. $71^{\circ} 16'$

Arc of direction, Sun sextile M.C. = $4^{\circ} 17'$

2. The next aspect of the Sun to the Midheaven in zodiac falls in Capricorn $26^{\circ} 28'$, which is the semisquare aspect of 45° .

The R.A. of this longitude is $298^{\circ} 29'$, and its meridian distance is therefore $298^{\circ} 29' - 249^{\circ} 56' = 48^{\circ} 33'$. Its ascensional difference is $28^{\circ} 40'$, which gives its diurnal semiarc $= 61^{\circ} 20'$.

Proportional log. $48^{\circ} 33'$ — prop. log. $61^{\circ} 20' =$ constant log. of aspect, .10150

To this we add the

prop. log. of Sun

as before, namely, .41028

.51178 $= 55^{\circ} 23'$ Sun's propor.
meridian distance;

which take from

$71^{\circ} 16'$ Sun's radical
distance,

remains

$15^{\circ} 53'$ the arc of direction Sun
semisq. Midheaven.

3. The next aspect of the Sun to Midheaven in zodiac is the conjunction. For this the calculation is simply the difference of their right ascensions.

That of the Sun is $321^{\circ} 12'$

That of the M.C. $249^{\circ} 56'$

Difference $71^{\circ} 16' =$ arc of direction.

These examples will doubtless serve for all cases that may arise in the course of directing a planet to the longitude and aspects of another in the zodiac.

We may now consider *converse* directions in the zodiac. These are calculated in exactly the same manner as the direct directions; but instead of moving the directed body forward in the heavens, that is, from the Nadir to the Ascendant, from the Ascendant to the Midheaven, from the Midheaven to the Occident, and so on, we move it conversely against the natural diurnal motion of the celestial bodies in the heavens. Thus, in the example horoscope the Moon is in Cancer $27^{\circ} 8'$. Therefore, to bring Saturn to the square aspect of the Moon in the zodiac, we have to bring it to Aries $27^{\circ} 8'$ by converse motion. We therefore find the meridian distance and semiarc of that point in the ecliptic, the meridian distance being taken from the lower meridian, to which it is nearest, and the semiarc being the nocturnal arc. Find the constant log. due to this point of the zodiac, and add to it the log. of the nocturnal semiarc of Saturn. From this we derive the proportional distance of Saturn from the lower meridian, and the difference between this and its radical distance is the arc of direction.

Similarly, we bring the Sun down the eastern heavens to form the converse zodiacal conjunction with Saturn. Here we take the meridian distance of Pisces $17^{\circ} 5'$, and also its semiarc. Find the con-

stant log. due to these and add to it the log. of the nocturnal semiarc of the Sun. The sum will be the prop. log. of the Sun's meridian distance at the conjunction, and the difference between this and the radical distance of the Sun from the same meridian will be the arc of direction.

The bodies of Jupiter, Mars, Mercury, Venus, Neptune, and Uranus are brought to the zodiacal conjunction with the ascendant conversely by the measure of their horizontal arcs, which are derived by subtracting the meridian distance from the semiarc.

Thus Jupiter comes to the conjunction with the ascendant in zodiac conversely in an arc of $9^{\circ} 21'$, Mars in an arc of $10^{\circ} 43'$, Mercury in an arc of $13^{\circ} 20'$, Venus in an arc of $39^{\circ} 27'$, Neptune in an arc of $41^{\circ} 14'$,¹ and Uranus in an arc of $44^{\circ} 8'$. Similarly, the Moon is brought to an opposition of the ascendant in zodiac by an arc of $2^{\circ} 30'$, which is the difference between its semiarc and meridian distance. This arc is much smaller than appears from its longitudinal position, and is due to the fact that the Moon has 5° of north latitude. A body with much north latitude sets much later and rises much sooner than does the degree of the ecliptic it holds. This is the radical difference between the mundane and zodiacal positions of a celestial body.

¹ An ephemeris of the approximate longitude and latitude of the planet Neptune from 1800 to 1900 A.D. is published by Messrs Foulsham & Co. Price 1s.

The Midheaven is directed to the conjunction with these planets in the zodiac by an arc equal to the difference of the R.A. of the Midheaven and that of the longitude of the planet.

Thus Venus comes to the Midheaven with the R.A. of Capricorn $5^{\circ} 49'$, which is $276^{\circ} 25'$, and the difference between this and the R.A. of the Midheaven $249^{\circ} 56' = 26^{\circ} 29'$ arc of direction of Midheaven conjunction Venus in zodiac.

Uranus comes to the Midheaven in the zodiac by an arc of $12^{\circ} 53'$, Neptune by an arc of $18^{\circ} 17'$, Venus by an arc of $26^{\circ} 29'$ (as above), Mercury by an arc of $46^{\circ} 44'$, Mars by an arc of $48^{\circ} 41'$, Jupiter by an arc of $52^{\circ} 36'$, and the Sun by an arc of $71^{\circ} 16'$. These arcs, it will be observed, differ from the meridian distances of the several bodies as given in the speculum by an increment which is due to the latitudes of the various bodies. The meridian distances in the speculum will be the same as the measure of their directions to conjunction with the Midheaven in mundo.

We may now pass to another series of directions.

CHAPTER V

ZODIACAL AND MUNDANE PARALLELS

IN astrology the parallel of declination is deemed of the same significance and value as the conjunction, but its effects are more lasting, and if formed near the tropics, Cancer 0 or Capricorn 0, they will last for years together and characterise a whole period of the life.

A *zodiacal* parallel is formed by directing a body to the place held by a zodiacal degree which has the same declination as that held by a planet to which direction is made.

Example.—The Sun at birth has $15^{\circ} 13'$ of declination. On the principle that all parallels of declination, being at the same distance from the Equator, act magnetically in unison, any body coming to an ecliptic degree which holds the same declination as the Sun, namely, $15^{\circ} 13'$, whether north or south of the Equator, will act as if in conjunction with the Sun. Reference to the tables will show that there are four points which have this same declination, namely, Aquarius $18^{\circ} 46'$, Taurus $11^{\circ} 15'$, and Scorpio $11^{\circ} 15'$. Therefore, if we

direct any body to any of these four longitudes in the zodiac by the rules given for directions in the zodiac, we shall bring them to parallels of the Sun in zodiac. The process is exactly the same as if we were directing to an aspect in the zodiac.

A *mundane* parallel is formed by the direction of a body to the same distance on one side of the meridian or horizon as that radically held by another body on the other side of the same meridian or horizon. These can be readily computed by reference to their horizontal arcs.

Example.—Bring Saturn to the mundane parallel of the Sun. The Sun's radical distance from the horizon northwards is determined by the difference of its meridian distance and semiarc, namely, $110^{\circ} 1' - 108^{\circ} 44' = 1^{\circ} 17'$, and we therefore have to bring Saturn to the same distance above the horizon. The semiarc of Saturn is $98^{\circ} 45'$, and its meridian distance $81^{\circ} 2'$; its horizontal arc therefore is $17^{\circ} 43'$. Then say: As the semiarc Sun is to its horizontal distance, so is the semiarc Saturn to its proportional distance, which, being added to the first or radical distance of Saturn from the horizon, will give the arc of direction.

Some writers on this subject have repudiated the parallel in mundo formed upon the horizon, but without adequate reason being adduced in support of their objection. Yet the same writers have not denied the efficacy of parallels formed on the *same* side of the meridian, one south and the other

north, as in the 4th and 9th houses, or the 11th and 2nd, 10th and 3rd, etc., forgetting that bodies so placed are at equivalent distances from the *horizon* !

The rule for parallels is the same as for aspects. As the semiarc of the stationary body is to its meridian distance, so is the semiarc of the moving body to its proportional distance, which, taken from its primary distance, or added if it passes into another quadrant in forming the aspect, will give the arc of direction.

Thus we may bring Saturn to a parallel with the Moon in mundo. The Moon here is $2^{\circ} 30'$ from the west horizon, and below it. If we bring Saturn along its own arc until it reaches a proportionate distance below the east horizon, we shall have a mundane parallel formed on the same side of the horizon, but on opposite sides of the meridian. We could work this problem by reference to the meridian distances of the two bodies from the Nadir, and the result would be the same.

It should be observed that the Sun and Moon are regarded as signifiers in the formation of mundane parallels by the other bodies, and the meridian and horizon therefore become sectors, upon which the parallels are formed.

Another form of the parallel in mundo is what is known as the *rapt parallel*. This is formed by the motion of the Earth on its axis, whereby the various bodies are carried from east to west at

their several relative distances from one another until they come to the same distance on either side of the meridian or horizon. In this case *both* bodies move in the prime vertical at a rate proportionate to their relative semiarc.

Rule.—As half the sum of their semiarc is to half the sum of their meridian or horizontal distances, so is the semiarc of the body applying to the angle, to its distance from that angle at the formation of the parallel. This distance taken from its radical distance from the same meridian or horizon will give the arc of direction.

What we are actually doing is to bring the meridian or horizon to the mid-distance between the Sun and a planet, or between the Moon and a planet. And these mid-distances are of the greatest significance, whether in the zodiac or in mundo. Here we are considering them only in mundo.

Example.—Bring the Moon and Saturn to a rapt parallel. This is formed on the lower meridian.

| | |
|---------------------------|---------|
| Semiarc, Moon (nocturnal) | 52° 51' |
| „ Saturn „ | 98° 45' |

2)151° 36'

Half sum of semiarc . 75° 48' prop. log. 37560

Arith. comp. 9.62439

| | | | |
|--------------------------|---|--------------|-------------------|
| | | Arith. comp. | 9.62439 |
| Merid. dist. of Moon | . | 50° 21' | |
| „ „ Saturn | . | 81° 2' | |
| | | <hr/> | |
| | | 2)131° 23' | |
| | | <hr/> | |
| | | 65° 41' | prop. log. 43782 |
| Semiarc, Moon . . . | . | 52° 51' | „ 53223 |
| | | <hr/> | |
| Proportional dist., Moon | . | 45° 48' | „ .59444 |
| Radical distance | . | 50° 21' | |
| | | <hr/> | |
| Moon rapt. par., Saturn | = | 4° 33' | arc of direction. |

Note.—In all cases where the Midheaven (meridian) and Ascendant (horizon) are employed as sectors, the Sun and Moon are employed as signifiers. They form aspects by their own apparent motions in the prime vertical, and the planets form aspects to the radical of the Sun and Moon by the same motion. This is the underlying principle of all parallels in mundo, and all rapt parallels. Remember that in mundane directions you are always dealing with the bodies themselves and not their longitudes.

CHAPTER VI

ORDER OF DIRECTING

THE student will do well to employ some definite method of noting the various directions, and of collating and tabulating his results, otherwise he is sure to overlook some that are important when considered in association with others that attend them, whether they be of the same or a contrary nature. Thus, if in a train or sequence of evil directions there should occur a good aspect of Jupiter to the Sun or Moon, the health and fortunes will be greatly sustained thereby, so that what would otherwise appear a fatal set of arcs, in the presence of this benefic arc of direction would lose that extreme significance, and, although sickness might supervene, the good direction would indicate a favourable crisis.

The following method is therefore suggested as inclusive of all legitimate directions.

1. *Mundane Directions*

(a) Direct all the bodies to aspects and conjunctions with the Ascendant from east to west and from west to east.

(b) Direct each of the bodies to all the aspects and the conjunction with the Midheaven, both ways.

(c) Direct the Sun to other bodies and their aspects in mundo, both ways.

(d) Direct the Moon to other bodies and their aspects in mundo, both ways.

(e) Direct each of the planets separately to mundane aspects and conjunctions with the Sun.

(f) Do the same in regard to the Moon.

(g) Direct the Sun to mundane parallels with the Moon and planets.

(h) Direct the Moon to mundane parallels with the Sun and planets.

(i) Direct the Sun to rapt parallels with the Moon and planets.

(j) Direct the Moon to rapt parallels with the Sun and planets.

2. *Zodiacal Directions*

Follow the same order as for mundane directions, omitting classes (g), (h), (i), and (j) (mundane and rapt parallels), which are not formed in the zodiac.

Note that in zodiacal directions a body is always moved to a longitude to form a conjunction or aspect, never the reverse of this. Also that the meridian and horizon are fixed circles which do not move in regard to any particular locality. The Midheaven and Ascendant are those points where

the ecliptic cuts through the meridian and horizon respectively.

All this long process of directing may appear to be very tedious. It certainly requires patience and method. But once done it lasts for a lifetime, which is a point to be considered. In possession of such a chart one may direct one's course with wisdom and success, avoiding those dangerous shoals, sandbanks, and breakers which occur in the course of every life—or, if it be beyond the power of a man so to do, he can at all events divest evils of much of their power over him by adjusting himself to them, making provision against times of evil fortune and doubling his efforts when times of prosperity are shown. Thus may a man order his going and bring his life to a peaceful end. Sudden death cannot overtake the man who has knowledge of the time of that event years in advance; and the keen edge of many afflictions, to which an all-wise Providence may dispose us for the greater ends of life, are dulled by a philosophic anticipation, so that, cutting less deeply, they leave the vital soul of man unhurt. Therefore, rather than pray that what is foreordained by the laws of life to the inscrutable ends thereof may be averted, let us rather pray with the Psalmist: "Teach me the number of my days, that I may apply my heart to wisdom."

CHAPTER VII

EFFECTS OF DIRECTIONS

IN order to complete this section of the work, which deals with that system of direction by semi-arcs currently practised and approved, it will be necessary here to indicate the general effects of directions, so that the nature and import of events may be known as certainly as the time at which they are likely to transpire. I am here speaking of "effects" of directions as if these latter had a direct dynamic result upon the character and actions of an individual. I am disposed to classify astrologers in three main groups—fatalists, casuists, and idealists—according to the various views they take of the nature and purport of astrology. The Fatalists believe, or profess to believe, that there is a planetary configuration and an event which attends it. They admit no possible intervention, amelioration, or extenuation. *Che sarà sarà*, and that is the end of the matter. They argue a certain necessity of connection between character and environment as we find it and planetary positions at the moment of birth. As regards "directions," all of which

are formed within a few hours of the birth, they speak of them as "seeds sown" in the plastic soil of the human soul which spring up and bear fruit at the appointed time, as measured by the arc of direction. They are born when they are born by necessity of universal law, and they die when they die because fatal arcs of direction are then in force.

They speak of laws of Nature as if they were dynamic forces against which mankind cannot possibly contend. They forget that laws are only mental concepts induced upon our minds by an apprehension of the correlated successiveness of events, and that what we know about natural laws is an infinitesimal part of the possibly knowable. They speak of the bodies of this microscopic solar system of ours as if they were the be-all and end-all of existence. They forget that the continuity of matter is a fact only on the material plane, and that there are forces of an immaterial nature which transcend both matter and what we call the laws of material existence. The moral law is an illustration of this. It is spiritual in its origin and spiritual in its effects. If astrology teaches fatalism, its use is at an end and it becomes a suicidal science, since there is no object in knowing that which must inevitably take place. It would reduce man to an automaton and divest him of all moral responsibility.

The Casuists are those astrologers who accommo-

date their facts and figures to popular concepts by a discreet use of a *mélange* of spurious philosophy. They forever quote the effete adage : " The wise man rules his stars, the fool obeys them " ; and that other which says : " The stars incline but do not compel. " They put a premium upon the wisdom of experience and the will-power of a purposeful character, and promptly consign a man to destruction by telling him that his horoscope indicates he has neither one nor the other. They do not suggest to him that astrology, properly conceived and applied, is in itself the very concrete of experience, nor that the will-to-be and the will-to-do are functions of the human soul which rise superior to all circumstance, outlasting life itself.

The Idealists are those among astrologers who regard the intelligible universe as the expression of a Supreme Intelligence, who regard the planetary combinations merely as symbols, knowing that the causes of all effects are within man himself, the cogniser of all experience. They regard the " signs of the times " as the driver of a locomotive regards the signals, not as " causes " of disaster, but as warnings against it, an open book to those who can read the signals, but of no value to those who cannot. They look upon the science of astrology as a wireless operator looks upon his code-book, merely as a means of interpreting the signals—a science evolved by man for the service of man.

My own view of the matter is that there is some-

thing to say for the materialist side of the question, and a great deal more for the idealistic. There is not the shadow of doubt in my own mind as to the material fact of the interaction of the planetary bodies, nor as to the fact that this interaction is registered by an intervening body of the system only at certain angles. The Platonic dictum that "God geometrises" is nowhere better illustrated than in the law governing the interaction of bodies belonging to the same system. The physical effects of the syzygies, and especially of ecliptic conjunctions of the luminaries, are immediately appreciable. The law of the tides is a concrete example of the fact of interplanetary action. We cannot deny the dynamic effects of planetary action on the material plane, and we have every reason for including in this category the human organism, compounded as it is of cosmic elements and in direct physical relations with a material environment. But that does not warrant us in extending our views to include the action of physical bodies upon the immaterial part of us, the only part of us that is essential and distinctively human. The only thing that can directly affect the soul of man is the soul of another human being. There is continuity of action upon all planes of existence because there is a continuity of matter upon all planes, but we have no grounds for extending the range of action from one plane to another plane, except it be by mediation or agency. Else we

could say that a good soul must be possessed of a sound body, a beautiful soul of a comely body, and that our moral principles are derived from what we eat and drink—instead of which, what we eat and drink depends on our moral principles. There is sound philosophy in the words of Tennyson when he says that “Soul to soul strikes through a finer element of its own.” It is capable of acting mediately through the physical body or immediately through its own essential being. These views will doubtless alter our viewpoint in regard to much that hitherto has been regarded as fundamental to a belief in astrology. The effort to accommodate the facts of astrology to the materialistic science of a generation ago has tended to this issue. Without in any way disposing of astrology as a physical science, it is high time that we learned to interpret the facts of that science in the light of the higher spiritual teaching to which we have access. Otherwise we shall debase the science and enslave our own souls. In such case it were better that our astrology had never been written. As a physical science, astrology has an immense future before it in this utilitarian age upon which we have embarked; but as a fatalistic creed it is not worth an hour’s study.

These remarks will enable the reader to understand why, in the following statement of the “Effects of Directions,” I have pursued the common practice of attributing certain results or

sets of conditions as accompanying the formation of "directions" or planetary combinations in the horoscope subsequent to the birth. They should not be regarded as inevitable "effects" of such directions, but rather as things signalled, as if we should hoist the red light to indicate "danger ahead," the green light for "caution," and the white light for "road clear." These signals do not cause disasters, but our ignorance of them, our inability to see them, or our wilful disregard of them may very well result in a catastrophe. Human science has harnessed many of the subtle and intangible forces of Nature and deployed them to the service of man. It may do the same with cosmic forces that are as universal as etheric action.

The Midheaven

This point of the horoscope stands for dignity, influence, authority, and position, the worldly honour and credit of the subject, and for all that is associated with his social and communal status. Good directions, such as the sextile and trine of all planets, and the conjunction and parallel of Jupiter, Venus (and Mercury when well aspected at birth), are indications of an enhanced position, higher honours, social distinctions, increase of prestige, etc.

Evil directions, such as the semisquare, square, and opposition of all planets (including the Sun and Moon in this category), and the conjunctions

and parallels of Uranus, Neptune, Saturn, and Mars, indicate assaults upon the good name and credit of the subject, hurt to the business affairs, loss of position, rivalries, and unprofitable associations.

The Ascendant

This point of the horoscope indicates things personal to the subject, as health, general welfare, comfort, environment, changes, and the common relationships of life, that which affects him through collective influence, the public state of affairs, etc.

Good aspects (as above enumerated) tend to benefit the subject by a variety of means differing as the nature of the planet which is in aspect by direction.

Evil aspects signal bad health, obstacles, hindrances, incommodities, troubles and annoyances of various kinds, according to the nature and position of the planet directed.

The Sun,

when in a hylegliacal place (as defined by Ptolemy), has significance of the vital constitution and life of the subject. Generally it stands for the father and male representatives of a family, and for the honour, credit, and position of the subject himself. It is thus associated more particularly with the Midheaven.

The Moon

denotes the health, changes of fortune, the mother and female representatives of the family, the functional powers of the body, and, in its association with the Ascendant, public bodies, the populace, and public concerns generally.

If in a hylegliacal position, it indicates the vital organs and life of the subject.

Note.—Ptolemy defines certain parts of the horoscope as being vested with a vital prerogative, wherein the Sun has precedence by day and the Moon by night. It is a moot point whether other bodies, being in such positions (in the absence of the luminaries), may not be vested with the same prerogative, and again, whether the Sun or Moon, not radically in such a position, may become invested with such significance by coming to a hylegliacal place by direction after birth. Failing either the Sun or Moon, Ptolemy invests the Ascendant with the properties of hyleg or life-giver. But, whatever may be concluded in this debatable matter, it is certain that the Ascendant is most generally affected by evil directions at the time of a physical crisis, the afflicting planet generally indicating the nature of its cause.

The above points in the horoscope, the Mid-heaven, Ascendant, Sun, and Moon, are the significators, because they signify such persons and things in the life of the subject as are capable

of being affected by the conflict of human circumstance.

All directions are made either (*a*) by the natural motion of the significators to the places and aspects of the planets, or (*b*) by the natural motions of the planets to the places and aspects of the significators.

The triangle (trine) and parts of it are good aspects, and indicate some advantage according to the position and nature of the planet directed. The cross (square) and parts of the square are evil aspects, and indicate similar disadvantages.

CHAPTER VIII

PLANETARY INDICATORS AND THE MEASURE OF TIME

THE following definitions of planetary indications are necessarily only partial and incomplete, but they will serve doubtless to convey a more or less definite idea of the nature of events which may be expected to attend directions formed by them with the various significators.

It should be observed that the house which a planet directed to holds in the horoscope of birth, or that which a planet which is directed arrives at when the aspect is complete, has chief significance in regard to the department of life in which the events will transpire, the nature of those events depending primarily on (a) the nature of the aspect and (b) the nature of the planet involved.

In this light, therefore, it may be said that *Neptune* in good aspect indicates events of a beneficial nature connected with the use of the faculties or some special faculty, and frequently in connection with a form of art ; benefits from unexpected sources coming mysteriously to the subject ; unseen

and intangible influences at work for the benefit of the subject ; brilliant flashes and inspirations of the mind ; spiritual aid ; intuitive activity.

In evil aspect by direction it denotes chaotic and mysterious events adverse to the interests ; scandal, secret enmity ; undermining of the credit by misrepresentation and fraud ; treachery, ambush ; an involved state of affairs ; nervous leakage and depletion of energy ; wasting of tissue ; physical ennui and decline of the vital powers from inscrutable causes ; apprehension, fear, and dread of consequence ; danger of espionage ; loss by fraudulent concerns and false investments ; mental unrest and loss of faculty.

Uranus in good aspect denotes civic and governmental honours, preference, advancement ; unexpected benefits arising out of public concerns and affairs ; ingenuity, inventiveness ; originality ; success in mechanical and engineering business ; strokes of good fortune coming from unexpected sources ; new associations and alliances.

In evil aspect this planet denotes the breaking down of existing relationships, lesions and fractures, partings and separations, loss of a sudden and unlooked-for nature ; hurt by strikes and public demonstrations ; nervous lesion, paralysis ; breaks and dislocations.

Saturn in good aspect indicates favours from aged persons and benefits from old associations, long investments, time contracts, and a general

state of stability and steadiness in the fortunes, congenial retirement and sequestration.

In evil aspect Saturn depletes the vital powers, causes physical hurts by falls and contusions, morbid diseases, colds and chills, inhibition of bodily functions; loss of money and property; mental and nervous depression; privations, obstructions, hindrances, and general misfortunes. Saturn is anciently known as the Greater Infortune.

Jupiter in good aspect denotes increase of fortune, opening up of new and lucrative opportunities, expansion of interests, advancement, progress, honours, confidence, good judgment, a general feeling of expansion and well-being, both physical and mental.

In evil aspect Jupiter denotes losses, errors of judgment, vanity or excessive confidence, disfavour of legal men and clericals, physical disabilities arising from congestion and surfeit, excess or over-indulgence, "too much of a good thing," too much *confidence en soi*, and consequent loss of esteem with others. It indicates a period of low finance, due to lavish expenditure, severe losses, or heavy investments. Jupiter is anciently known as the Greater Benefic, but it is certain that its evil aspects denote anything but a beneficial state of affairs.

Mars in good aspect denotes activity, new enterprises, great output of energy with commensurate good results, travelling, the executive powers are stimulated, and much profitable work is done.

Benefits accrue from military men, business connected with iron, steel, and fire. The muscular system is strengthened and there is a disposition to increased activity. Honours due to deeds of daring and chivalry. Women frequently marry under this aspect.

In evil aspect Mars denotes hurts by burns, scalds, fire, and steel, with loss of blood, abrasions and cuts, and also fevers and inflammatory conditions of the body or that part of it indicated by the position of Mars by direction. Loss by fire or theft, sometimes attended by violence. Sudden alarms and disasters of various sorts. Mars was anciently known as the Lesser Infortune.

The *Sun* in good aspect indicates increase of prestige, honours and emoluments, new friends and associations of a creditable character, general advancement and good fortune.

In evil aspect the Sun denotes losses, disfavour of superiors, troubles through male members of the family, the chief, overseer, or manager of a business ; loss by governing bodies ; ill-health due to fevers. Reverses of various sorts according to the house in which the direction is completed.

Venus in good aspect signifies social and domestic success, pleasures and enjoyments, gifts and presents, decorations ; the young court or marry, and the mature have children born or daughters engaged or given in marriage, and such events happen as cause pleasure and satisfaction. The

affectional nature is stimulated and the health is good.

In evil aspect Venus denotes sorrows, disappointments, bereavements, grief, and losses, domestic and social troubles, and hurts associated with young women or children. Venus was anciently known as the Lesser Benefic, and the less one has of it when in evil aspect the better for all concerned.

Mercury acts in terms of the planet to which at birth it is in closest aspect ; but if not within orbs of an aspect with any planet, then in terms of the ruler of the sign it occupies. In good aspect it usually signifies activity, much occupation of a profitable nature, connected with writings, science, and business of a general nature. Travelling, profitable journeys, good news, gain in connection with the avocation or trade. An active time generally.

In evil aspect Mercury produces annoyances and disturbances, evil news, worry and anxiety, many short journeys to and fro to no purpose or profit, sleeplessness, irregular feeding, unrest.

The *Moon* in good aspect denotes pleasant and profitable changes, a change for the better in the general state of affairs, gain by public associations and concerns, favours from women of mature age, popularity.

In evil aspect it denotes loss by any of the above means, and a state of unrest both physical and mental which leads to neglect of duties and conse-

quent loss. Hurts from women. Some public affronts may be suffered. Changes are unfortunate, and best avoided.

The Measure of Time

In the foregoing system of primary directions by proportion of the semiarc, the measure of time is $1^{\circ}=1$ year, and every $5'=1$ month.

Considerable discussion has been devoted to the question of time measurement in directions. Those who advocate the Arabian system of a day for a year have sought to bring primary directions into line with that system by equating arcs of direction made on the foregoing principle of semiarc, by adding the arc to the Sun's right ascension at birth, and then finding the day after birth at which the Sun attains this new right ascension. The count is made at the rate of one day for a year of life, and two hours for every month.

Others, again, have sought to apply a plus increment at the ratio of 365 to 360, seeing that the Sun moves through 360 degrees in 365 days, which is the same as taking the Sun's mean motion $59' 8''$ as the value for $1 \text{ day}=1$ year.

But it is obvious that none of these methods has any direct application to the system we are now concerned with, inasmuch as all the directions formed by the diurnal rotation of the Earth on its axis are formed within a few hours of birth so far as they apply to a life of ordinary length, and

they are measured in degrees of right ascension—that is to say, by the passage of the Equator under the local meridian in the prime vertical,—and therefore degrees of right ascension are the only uniform basis of measurement. It certainly does not seem consistent to measure arcs by one method and equate them in terms of another.

It should be observed, however, that primary directions in right ascension do not always coincide exactly with the events they are held to signify. Sometimes they are too short, and sometimes too long, but never more than a few minutes either way. Commander Morrison, R.N., was of opinion that the event signified was delayed or accelerated by reason of current transits in the horoscope at the time, and he further states that the chief effects may be expected to transpire when the lunar or secondary directions come into accord with them. This gives rather a wide margin of operation to the primary direction, and has led many to the conclusion that the secondary direction is, after all, the important one and deserving of primary consideration. A very little experience will show that it is not so, for, unless there are concurrent primaries in operation, lunar or secondary directions frequently pass with little or no result.

Primary directions and transits appear to answer to all the more important events in life.

At the same time we have to consider the *duration* of effects, and in regard to this it has been observed

that the process of formation of an arc of direction should be considered. For the longer a direction may be in forming, the longer will those events endure which it signifies. Here we have Fitzroy's old maxim again in evidence: "Long foretold, long last: short notice, soon past."

Thus an aspect to the Ascendant formed during the rising of a sign of short ascension such as Aquarius, Pisces, Aries, Taurus in northern latitudes, and the opposite signs to these in southern latitudes, will be speedily formed and over. On the other hand, a similar direction formed to the Ascendant when in a sign of long ascension will be formed more slowly, and will dissolve more slowly. In such case we might expect the signified event to begin to happen earlier and to end later than in the former case.

One finds in experience, however, that men frequently trace years of toil and suffering to a sudden disaster overtaking them in a moment. In my theory of transits, this could not happen in earlier years, but might easily occur at maturity when the accumulated results of a man's labour were heaped around him. (See Transits.)

The following illustrations will, however, sufficiently prove that there is adequate coincidence between arcs of direction and the events they are held to signify, to warrant the measure of time $1^{\circ}=1$ year as scientifically valid.

CHAPTER IX

ILLUSTRATION

IN the example horoscope given in these pages we have a singularly interesting subject. The chief events of the life are well defined and closely indicated by the attendant arcs of direction. Hundreds of horoscopes, whether pertaining to individuals in high walks of life or of modest position in the world, could be adduced to show that this coincidence of direction and event is not fortuitous, but regular and consistent, and as dependable as any astronomical formulary. The student will find pleasure and instruction in working out the following arcs of direction in the present instance.

John Ruskin leapt into fame and became a "lion" in the world of art in the autumn of 1843 under the direction of

Sun sextile Midheaven mundo $24^{\circ} 37'$

He was married on the 19th April 1848, and, while on his honeymoon, took a chill while sketching in Salisbury Cathedral and was seriously ill. This happened under the adverse directions—

Moon oppos. Venus mundo conv. $29^{\circ} 16'$

Moon square Venus mundo dir. $29^{\circ} 16'$

The nearness of these adverse arcs to the event of marriage proved unfortunate for such a domestic change. The danger of his choice of a wrong time and a wrong partner for marriage was radically indicated by the Moon's opposition to Mars and Mercury, and nothing but constant bickering could have been expected from such indications.

The first serious break in Ruskin's health was in May 1840, for which we have the direction—

Moon oppos. Saturn zod. $21^{\circ} 46'$

He received honours from the University of Cambridge in May 1867 under the appropriate directions of

Ascendant trine Venus mundo $48^{\circ} 2'$

Ascendant sextile Moon zod. $48^{\circ} 22'$

He was elected Slade Professor of Fine Art on the 10th August 1869, and commenced his course of lectures under the following directions :

Ascendant trine Jupiter zod. $50^{\circ} 35'$

Midheaven par. Jupiter zod. $50^{\circ} 57'$

Ascendant par. Jupiter zod. $51^{\circ} 14'$

Moon rapt par. Jupiter $51^{\circ} 22'$

In the following year his health gave way, and his mother died in December of that year, 1871. The arc for that year measured from $51^{\circ} 53'$ to $52^{\circ} 53'$, and within these limits we have the significant directions—

| | |
|-----------------------------------|---------|
| Ascendant square Saturn zod. con. | 51° 59' |
| Moon square Mars mundo | 52° 0' |
| Sun par. Uranus zod. con. | 52° 0' |
| Ascendant square Jupiter mundo . | 52° 41' |

followed by Moon par. Mars zod. 53° 3', close upon the death of his mother.

His health completely broke down again in 1888, under the directions—

| | |
|---------------------------------------|---------|
| Sun opposition Uranus zod. | 68° 49' |
| Sun opposition Uranus mundo | 69° 14' |
| Moon rapt par. Saturn | 69° 30' |

Here the Sun is hylegliacal, and, being so heavily afflicted from angles of the horoscope, and the Moon also afflicted by Saturn, only disastrous illness and misfortune could have been signified.

Nevertheless, he survived this affliction, and further added to his reputation as a man of letters and exponent of fine art during some ten years, until eventually, with declining vitality laying him open to attack, he was afflicted by influenza and succumbed on 20th January 1900, the arc for that date being 80° 57'. The following significant train of directions was then in force :

| | |
|-------------------------------------|---------|
| Sun par. Uranus zod. | 80° 10' |
| Ascendant square Saturn mundo . | 81° 2' |
| Ascendant sesquiq. Sun zod. | 81° 11' |
| Ascendant par. Uranus zod. | 81° 27' |
| Moon square Mars zod. con. | 81° 30' |

In view of these directions, it cannot be said that we are not duly signalled by the celestial bodies, not only of the approach of evil times, when more than usual care and attention are due to health and fortunes, but also of those periods of good fortune when the sun smiles upon all our efforts and stimulates us to greater endeavours. The fault is altogether ours if we do not regard these portents. The beneficent Creator, having established these celestial bodies "for signs and for seasons," is ever faithful. He puts up the signals on every occasion. It is for us to apprehend and read them.

In King Edward VII.'s horoscope we have the attachment which led to his marriage indicated by

Venus conjunction Moon mundo . $19^{\circ} 25'$
 Moon conjunction Venus con. . $20^{\circ} 7'$

The attempt on his life by the maniac Sipido, when as King he was travelling in Germany, measures to an arc of $58^{\circ} 25'$, and the appropriate direction was—

Sun opposition Neptune zod. $58^{\circ} 21'$

The death of the Empress Frederick (Princess Royal) in August 1901 was indicated by the direction—

Midheaven conjunction Saturn $59^{\circ} 43'$

The death of his royal mother, Queen Victoria,

requires an arc of $59^{\circ} 14'$, and we find the appropriate directions—

| | |
|-----------------------------------|--------------------|
| Midheaven square Moon zod. | . $58^{\circ} 58'$ |
| Ascendant opposition Moon . | . $59^{\circ} 19'$ |
| Saturn semisq. Ascendant . | . $59^{\circ} 22'$ |
| Midheaven conjunction Saturn zod. | $59^{\circ} 42'$ |

These illustrations will doubtless serve for all practical purposes, and they can be worked out at leisure by those who wish to exercise themselves in this art.

Other methods than that here illustrated must claim our attention, inasmuch as they have consistently been advocated by various authors. There are, moreover, several points which may be considered as debateable, and these also have to be considered before our work is rendered complete. We must therefore pass on.

CHAPTER X

PTOLEMY AND PLACIDUS

It is generally conceded that the system of directing which has so far occupied our attention first originated as a measure of time in the mind of Claudius Ptolemy, the famous geographer, mathematician and astronomer of Alexandria, who flourished in the second century of our era, and wrote a standard work on the subject of astrology called in the Greek *Tetrabiblos*, and in the Latin *Quadripartite*, being four books on the Influence of the Stars. He also wrote the *Syntaxis* and the *Almagest*, which, together with his work on astrology, have been translated into every language in Europe and into many Oriental languages also.

From the writings of Sir Isaac Newton we have evidence that there were many sources of information open to Ptolemy in the pursuit of astrological knowledge, and there is no reason to suppose that he did not avail himself of them fully, for none has ever suggested that astrology as a science was first promulgated by him. But it may certainly be

affirmed that Ptolemy gave to the Western world the first scientific exposition of the subject. There are two Latin editions of the work and one in Greek. The best translation that we have is the paraphrase of Proclus from the Greek text rendered into English with extensive commentary by J. M. Ashmand, and recently published as a supplement to *Coming Events*. Ashmand has followed the Elzevir text, dated 1635.

The name of Claudius Ptolemy will be revived wherever astronomy and astrology are studied. It is enough for the purpose of this sketch to note that he was born at Pelusium in Egypt, and became a brilliant disciple of the Alexandrian School. It appears that he was born about the year 80 A.D., flourished during the reigns of Adrian and Antoninus Pius, and died in the seventy-eighth year of his age.

Of Placidus de Titus, who first rendered a studied version of Ptolemy's work on astrology, we have very little information. It appears that he was known as Didacus Placidus, and was a native of Bologna, became a monk, and was appointed mathematician to the Archduke Leopold William of Austria. He wrote in the early part of the seventeenth century a work entitled the *Primum Mobile*, in which he gives a thorough digest of the teaching of Ptolemy. The best English translation is by Cooper. Placidus showed that Ptolemy recognised two sets of directions arising out of

two sets of planetary positions, one in the zodiac and the other in the world, *i.e.* in the prime vertical. To Placidus remains the credit of having elaborated that part of directional astrology which has regard to directions in mundo.

Ptolemy makes it clear in his chapter on the "Number of the Modes of Prorogation" (bk. iii., ch. xiv.) that "when the vital prerogative is vested in the Ascendant, the anareta or killing planet may be brought to it by oblique ascension; and if it be vested in the Midheaven or a body there situate, then direction is to be made by right ascension. If on the occidental horizon, the degrees of oblique descension are to be reckoned. But if not in either of these three places, but in some intermediate station, it should be observed that 'other times' will bring the succeeding place to the preceding one, and not the times of ascension or descension nor of meridian transit as already declared.

"For, if it be desired to calculate agreeably to nature, every process of calculation that can be adopted must be directed to the attainment of one object—that is to say, to ascertain in how many equatorial times the place of the succeeding body or degree will arrive at the position preoccupied at the birth by the preceding body or degree, and, as equatorial times transit equally both the horizon and the meridian, the places in question must be considered in regard to *their proportionate*

distances from both these, each equatorial degree being taken to signify one year."

Here Ptolemy makes it clear that he directs a body in the heavens to one that precedes it, or a body to a degree that precedes it, which direction is formed by the diurnal rotation of the Earth on its axis from west to east. He also makes it clear that he uses the proportionate distances of bodies from both the horizon and meridian as the basis of the calculation, and the arc of direction is the intervening degrees (equatorial) between them, at the rate of one equatorial degree for a year of life.

It is evident, therefore, that he takes a proportion of the semiarcs, or, as he calls them, "the horary times," of the planets involved. These arcs he describes as parallel to one another and to the Equator, but cutting the circle of the horizon at various degrees of obliquity.

Obviously, therefore, we have to take proportion of their semiarcs and meridian distances, exactly as we have been instructed in the foregoing exposition; and as these semiarcs are regulated by the latitude of the place of birth and the corresponding ascensional differences of the planets, the positions of the bodies will have respect to the prime vertical and will be their apparent places in the plane of that circle. But it is important to note that Ptolemy says nothing concerning converse directions, whether in mundo or in the zodiac.

That he recognises the mundane position of a body as distinguished from the apparent place of its "degree" of longitude is obvious from his mentioning both in the same sentence; and we distinguish ourselves between the mundane and zodiacal conjunctions only by reference to the body of the planet in the first instance and its longitude in the other case.

To Claudius Ptolemy, therefore, may rightly be accorded the honour of having set astrologers upon the right track with regard to the correct measure of time by reference to the equatorial degrees separating one body from another, or one body from the longitude or aspect of another, as seen from the place of birth.

There is little doubt, from the illustrations of his method that Ptolemy gives, that he uses the "ascensional" times in all cases due to the latitude of the place of birth; and this method serves very well not only for directions to the Ascendant and Descendant, but also for intermediate positions when the planets are in the same or different quarters and on the same side of the meridian, for then their arcs may be measured with great facility and approximate accuracy from the Tables of Houses alone.

Illustration

1. Bring the Sun to the place of Mars in the horoscope of Ruskin.

| | h. | m. |
|------------------------------------|----|----|
| The sidereal time on the Midheaven | | |
| when Mars' place rises is . . . | 15 | 49 |
| That when the Sun rises is . . . | 16 | 44 |
| <hr/> | | |
| Difference in R.A. on the Mid- | | |
| heaven in S.T. | 0 | 55 |

Divided by 4, this gives $13^{\circ} 45'$ as the arc of direction.

The same arc of direction when exactly calculated by the semiarc method is $13^{\circ} 49'$.

2. Bring the Sun to the conjunction with Venus in zodiac.

| | h. | m. |
|---------------------------------------|----|----|
| The S.T. at sunrise (as above) is . . | 16 | 44 |
| That when Venus' place rises is . . | 14 | 35 |
| <hr/> | | |
| Difference | 2 | 9 |

This gives an arc of $32^{\circ} 15'$.

3. Bring Saturn to the place of Sun in zodiac.

The declination of Saturn is $6^{\circ} 54'$ S., and this answers to the longitude of Pisces, $12^{\circ} 37'$.

| | h. | m. |
|------------------------------------|----|----|
| S.T. on Midheaven when this point | | |
| rises | 17 | 30 |
| S.T. on Midheaven when Sun rises . | 16 | 44 |
| <hr/> | | |
| Difference | 0 | 46 |

This gives an arc of $11^{\circ} 30'$.

4. Bring the Moon to the opposition of Venus in zodiac.

The declination of the Moon is $25^{\circ} 39'$, which exceeds that of any degree of the zodiac owing to the Moon's extreme latitude north added to the declination of its longitude. But reference to the Tables of Ascensional Difference and Right Ascension will show that its oblique descension answers to the twelfth degree of the sign Leo, which is the same as the oblique ascension of Aquarius 12° . Then the arc between the place and Venus in zodiac and Aquarius 12° will be the arc of direction. Thus :

| | h. | m. |
|------------------------------------|-------|----|
| S.T. on Midheaven when Venus long. | | |
| rises | 14 | 35 |
| S.T. on Midheaven when the 12th of | | |
| Aquarius rises | 16 | 30 |
| | <hr/> | |
| Difference | 1 | 55 |

This gives an arc of $28^{\circ} 45'$.

5. Bring the Sun to the opposition of Uranus in zodiac.

Take the opposite degree of the zodiac to that held by Uranus, and bring the Sun to it by oblique arc.

| | h. | m. |
|---|-------|----|
| S.T. when Gemini $23^{\circ} 25'$ rises | 21 | 21 |
| S.T. when Sun rises | 16 | 44 |
| | <hr/> | |
| Difference | 4 | 37 |

This gives an arc of $69^{\circ} 15'$.

6. Bring Sun to par. Uranus in zodiac direct.

The declination of Uranus is $23^{\circ} 24'$, which answers to that of Cancer 4° . Find the arc between this and the Sun.

| | h. | m. |
|---|-------|----|
| S.T. on Midheaven when Cancer 4° | | |
| rises | 22 | 6 |
| S.T. on Midheaven when Sun rises | | |
| in Aquarius $18^{\circ} 45'$ | 16 | 44 |
| | <hr/> | |
| Difference | 5 | 22 |

This gives an arc of $80^{\circ} 30'$.

These examples will serve to show that without recourse to the elaborations of a speculum or the use of proportional logarithms in the computation of proportional arcs, Ptolemy could, by the mere use of a table of ascensions under any latitude, find the time of an indicated event within an arc of $30'$ and even less, which, having regard to the approximations which are frequently adduced as "arcs for the event" when both are accurately known, show that they would serve for all practical purposes. I most frequently calculate arcs of direction in this manner, bringing out the results to the nearest quarter of a degree, which measures to three months of time. Ptolemy had constructed such tables, as appears from his *Almagest*, and this is obviously the method he used. In other words, he recognised no other directions than those that could be calculated by the difference of the oblique ascensions of the planets and of their longitudes,

taking the oblique ascension of their opposite degrees when the arc was formed by descension of a body.

A table of oblique ascensions such as that published by Worsdale enables the calculation to be made with even closer exactness. It has only to be remembered that when we are directing the body of a planet to the body or longitude of another, the longitude corresponding to its declination must be dealt with, and not the longitude of the body itself, as the above examples will sufficiently indicate.

CHAPTER XI

DIRECTIONS UNDER POLES

THIS method has been much advocated, and especially by Mr R. C. Smith, the first of the almanac writers under the pen-name of "Raphael." It consists in directing a significator under its own pole instead of under the pole of the place for which the horoscope is cast.

To find the Pole of a Planet

Take its R.A., declination, and semiarc.

Then say :

As the semiarc is to 90° ,

So is its meridian distance

To the difference of its circle of position and
the meridian.

And this difference, compared with its meridian distance, will give its ascensional difference under its own pole.

Then having this and also its declination, from the sine of its ascensional difference under

its own pole take the tangent of its declination, and the remainder will be the tangent of its pole.

Example.—In the horoscope of Ruskin find the pole of the Sun.

The R.A. of Sun is $321^{\circ} 12'$, the meridian distance (below) $108^{\circ} 44'$, the semiarc $110^{\circ} 1'$, and the declination $15^{\circ} 13'$.

| | | | | |
|--------------------------|---|-------------------|------------|----------|
| Semiarc $110^{\circ} 1'$ | . | . | prop. log. | 0.21381 |
| | | Arith. comp. | . | 9.78619 |
| Quadrant of 90° | . | . | . | 0.30103 |
| Meridian distance | . | $108^{\circ} 44'$ | | 0.21891 |
| | | | | <hr/> |
| Difference | . | $88^{\circ} 57'$ | | 0.30613 |
| | | | | <hr/> |
| Asc. diff. under pole | | $19^{\circ} 47'$ | log. sine | 9.52951 |
| Sun's declin. | . | $15^{\circ} 13'$ | log. tang. | 9.43458 |
| | | | | <hr/> |
| Pole of Sun | . | $=51^{\circ} 13'$ | log. tang. | 10.09493 |

It is thus seen that the pole is measured along the tangent by its distance from the meridian or nadir, according as the body may be above or below the Earth at the time. At the meridian the pole would be 0, and at the horizon it would be the same as the latitude. Here "pole" is the same as polar elevation. The difference $88^{\circ} 57'$ indicates the place of the circle of position from the

plane of the meridian circle. Circles of position are small circles which are parallel to the great circle of the meridian and at right angles to the great circle of the horizon. They are like lateral circles of latitude in relation to which the meridian stands as equator and the Ascendant and Descendant as poles. Hence, if a planet be on the cusp of a house, it will have the same pole as that house.

Having calculated the poles of all the planets, and of the Sun and Moon, direction of one to another of them is thus made.

Rule.—Take the oblique ascension (or descension, as the case may be) of the promittor or body directed to under the pole of significator, and the difference of this from the oblique ascension (or descension) of the significator under the same pole is the arc of direction.

To find the oblique ascension of a body under the pole of another directed to it, to the log. tang. of its declination add the log. tang. of pole of the body directed, and the sum will be the log. sine of its ascensional difference under that pole. From this its oblique ascension can be found by referring it to its R.A. according to the rule (see “Definitions,” Chapter I.).

Example.—Direct the Sun in the example horoscope to the place of Venus in the zodiac.

The declination of Capricorn $5^{\circ} 49'$ is $23^{\circ} 20'$. The Sun's pole is $51^{\circ} 13'$. Then—

| | | |
|---------------------------------|------------|----------|
| Pole of Sun, $51^{\circ} 13'$. | log. tang. | 10.09493 |
| Dec. Venus long. . | log. tang. | 9.63484 |

| | | |
|---------------------------------------|-----------|---------|
| Asc. diff. of aspect $32^{\circ} 28'$ | log. sine | 9.72977 |
| R.A. of aspect . $276^{\circ} 20'$ | | |

| | |
|------------------------------------|---------------------|
| O.A. of aspect . $308^{\circ} 48'$ | under pole of Sun. |
| O.A. of Sun . $340^{\circ} 59'$ | under its own pole. |

Diff. . $32^{\circ} 11'$ = arc of direction.

Applying this method to the hint I have already given as to the use of tables of oblique ascension, or tables of houses for various latitudes, we can calculate this arc perfectly well with a table of the houses for latitude $51^{\circ} 13'$, which is the pole of the Sun. And we can calculate all the solar arcs by this means from the same table. Then if we find the pole of the Moon, and refer to the Table of Houses for equivalent latitude, we shall be able to take out all the directions of the Moon under its own pole. The directions of the Ascendant will, of course, be made under the pole of the place of birth, and those of the Midheaven by right ascension only. So that what appears at first a complex and exhaustive piece of work can readily be done by tables of houses, or tables of oblique ascension for various latitudes, in next to no time, as the saying is. And this, I think, may be adjudged the most popular contribution to the theory

and practice of primary directions that I have been able to make.

Example.—Direct the Sun under its own pole to the opposition of Uranus in the zodiac.

The Sun's pole is $51^{\circ} 13'$. Therefore take in hand the Tables of Houses or the Tables of Oblique Ascension for latitude $51^{\circ} 13'$ N.

The opposition of Uranus falls in Gemini $23^{\circ} 25'$.

| | h. | m. |
|---------------------------------------|-------|----|
| S.T. on Midheaven when Gemini | | |
| $23^{\circ} 25'$ rises | 21 | 21 |
| S.T. when Sun's place rises | 16 | 43 |
| | <hr/> | |
| | 4 | 38 |

This converted into arc of R.A. = $69^{\circ} 30'$ = arc of direction.

Example.—Direct the Sun under its own pole to Venus in the zodiac. Pole of Sun = $51^{\circ} 13'$.

| | h. | m. |
|---------------------------------------|-------|----|
| S.T. on Midheaven with Sun | | |
| rising | 16 | 43 |
| S.T. on Midheaven with Capri- | | |
| corn $5^{\circ} 49'$ rising | 14 | 35 |
| | <hr/> | |
| Arc of direction, Sun conj. Venus | | |
| zodiac = difference | 2 | 8 |

This is equivalent to $32^{\circ} 0'$.

By exact calculation we found it formerly to be $32^{\circ} 11'$. The difference is inconsiderable from the point of view of probable time of the event.

As to the merits and demerits of these divergent systems of directing, I leave my readers to decide for themselves. *Experientia docet*. I hold no brief for either system, my business being merely to represent and to simplify. This I think I may claim to have done.

The system of directing under the semi-arcs in the prime vertical is that which was followed by Ptolemy. The system of directing under the poles of the planets is of considerably more recent origin, and dates to the seventeenth century only. It consists, as will be seen, in directing in the circle of observation due to the pole of the significator or planet directed. The difference is that which one may note as between the tables of houses for one latitude and another. Nothing is simpler or more demonstrable. I leave it at that.

But in general practice it will be found that equally close results may be obtained by simple proportion and the use of the tables. Take the following hint for what it is worth. I am quite satisfied in my own mind that what we call primary directions seldom or never operate exactly to time, and if we correct the observed time of birth by one direction for an event we shall find that subsequent directions are not on schedule time. We have to allow a latitude for the operation of these directions. Such being the case, and, in the experience of the best artists, the import of primary directions being accelerated or retarded by the

secondary directions and transits, we do not need to observe scruples. Approximations are always valuable.

The following may be regarded as the *via lætitia* in primary directing:—

Rule 1.—As the semiarc of the planet whose pole is required is to 90° of the prime vertical, so is the distance of the body in right ascension from the meridian (upper or lower as the case may be) to its proportional distance in the prime vertical.

Rule 2.—From the sine of their difference subtract the tangent of the planet's declination. The remainder is the tangent of its pole.

Rule 3.—For all directions under the pole of that planet or significator use the Tables of Houses for that latitude which answers to its pole.

Rule 4.—Find the difference between the ascension of the body (by sidereal time or right ascension on the Midheaven) and that of the planet directed to. This will be the arc of direction.

Note.—If the planets involved or the positions involved are between the tenth and fourth westward, take the ascensional degrees of the opposite places.

Rule 5.—Direct the Midheaven by right ascension only, and the Ascendant by oblique ascension under the latitude of birth. Direct the Sun under its own pole and the Moon under its own pole. This completes the entire scheme of primary directing.

Example.—In the horoscope of Ruskin the Sun

was found to have a pole equal to the latitude of $51^{\circ} 13'$ N. (see p. 72). It must therefore be directed under the Ascendant of $51^{\circ} 13'$. Similarly, the Moon, whose pole is $47^{\circ} 27'$, must be directed under the latitude of that degree. A significator on the Midheaven would thus be directed by right ascension only, as stated by Ptolemy (see p. 64).

For directions of the Sun to other bodies, therefore, we use the Tables of Houses for $51^{\circ} 13'$. Those for Taunton are $51^{\circ} 1'$, which is deemed near enough.

1. Direct the Sun to Jupiter in the horoscope.

| | h. | m. |
|---|----|----|
| S.T. on Midheaven with Sun rising | 16 | 41 |
| S.T. on Midheaven with Jupiter's long. | | |
| rising | 15 | 55 |
| <hr/> | | |
| Arc of direction = $11^{\circ} 30'$, equi- | | |
| valent to S.T. | 0 | 46 |

2. Direct the Sun to Mars.

| | h. | m. |
|---|----|----|
| Sun rising as before, S.T. on Midheaven | 16 | 41 |
| Mars rising, S.T. on Midheaven | 15 | 43 |
| <hr/> | | |
| Arc of direction = $14^{\circ} 30'$ | 0 | 58 |

3. Direct the Sun to Mercury in zodiac.

| | h. | m. |
|---|----|----|
| Sun's rising as before | 16 | 41 |
| Mercury's longitude rising | 15 | 39 |
| <hr/> | | |
| Arc of direction = $50^{\circ} 30'$ | 1 | 2 |

4. Direct the Sun to Venus' longitude.

| | | | h. | m. |
|-------------------------------------|---|---|----|----|
| Sun's rising as above | . | . | 16 | 41 |
| Place of Venus rising | . | . | 14 | 30 |
| <hr/> | | | | |
| Arc of direction = $32^{\circ} 45'$ | . | . | 2 | 11 |

5. Direct the Sun to Neptune in zodiac.

| | | | h. | m. |
|-------------------------------------|---|---|----|----|
| Sun's rising as before | . | . | 16 | 41 |
| Neptune's long. rising | . | . | 13 | 59 |
| <hr/> | | | | |
| Arc of direction = $40^{\circ} 30'$ | . | . | 2 | 42 |

6. Direct the Sun to Uranus in zodiac.

| | | | h. | m. |
|-------------------------------------|---|---|----|----|
| Sun's rising as above | . | . | 16 | 41 |
| Uranus' long. rising | . | . | 13 | 36 |
| <hr/> | | | | |
| Arc of direction = $46^{\circ} 15'$ | . | . | 3 | 5 |

7. Direct the Sun to opposition of Moon in zodiac.

| | | | h. | m. |
|--|---|---|----|----|
| Sun's rising as before | . | . | 16 | 41 |
| Rising of Capricorn $27^{\circ} 8'$, S.T. | . | . | 15 | 47 |
| <hr/> | | | | |
| Arc of direction = $13^{\circ} 30'$ | . | . | 0 | 54 |

The various aspects to these promittors can be picked up *en route* as we bring the Sun from the horizon to the Midheaven, which it reaches in an arc of $69^{\circ} 59' = 70$ years nearly.

We cannot direct Sun to Saturn by the diurnal motion of the Earth, and so we must bring Saturn

up to the Sun's place. This involves knowing the pole of Saturn.

We may also bring Saturn to the Ascendant under its own pole. But if we were to bring the Sun to Saturn under the Sun's pole, that would be a *prenatal direction*, for the Sun cannot go back from the position it has attained and sink below the eastern horizon. We have therefore no alternative but to regard these directions as invalid, or to admit the thesis already suggested, that in these directions, made contrary to the apparent motion of the bodies in the heavens, we are dealing with the localised impress of the planet at the moment of birth, which impress is carried by the Earth up the western heavens and down the eastern heavens, so that the Sun's localised imprint is here carried down to the place of Saturn. And this is conformable to the theory of directions under the poles of the significators.

CHAPTER XII

THE PART OF FORTUNE

For a considerable time there was much discussion as to the correct method of finding the place of the Part of Fortune. This, it should be explained, is one of the old Arabic points, which, like the Pomegranate, the Sword, and others, were regulated by the distances of the several bodies from the Sun in the zodiac, the particular point referred to being the same distance in zodiacal degrees from the Ascendant.

It was when astrologers came to apply this theory to the system of primary directions in vogue that the trouble arose as to the correct method of computing this point.

I think that the easiest expression of the case is this :—the Part of Fortune is a mundane point answering to the distance of the Moon from the Sun in the zodiac. Thus in the horoscope of Ruskin the Moon wants $21^{\circ} 38'$ from the opposition of the Sun, and therefore the Part of Fortune will be $21^{\circ} 38'$ below the western horizon in mundo.

Its mundane position will therefore be $8^{\circ} 22'$ inside the 6th house.

Its meridian distance will be $68^{\circ} 22'$, and its pole $39^{\circ} 13'$. Under this pole we may direct it to aspects in the zodiac, and in mundo. It has been suggested that the Part of Fortune cannot be directed, but can only receive directions from other significators and the planets. This is surely nonsense. Any point in the heavens having been defined and located is carried by the motion of the Earth on its axis from its radical place to others successively in a direction that is contrary to the rotation of the Earth. Hence the Part of Fortune will here be carried down the heavens from the 6th to the 5th and from that to the 4th house successively, forming both mundane and zodiacal aspects under its own pole. The pole of the Part of Fortune and that of Saturn being near to one another, they must be near a mundane parallel, on the same side of the horizon.

There are, however, other suggested methods of taking the place of the Part of Fortune.

Ptolemy says (bk. iii., ch. xii.): "The Part of Fortune is ascertained by computing the number of degrees between the Sun and Moon, and it is placed at an equal number of degrees from the Ascendant in the order of the signs. It is in all cases, both by day and night, to be computed and set down, that the Moon may hold with it the same relation as that which the Sun may hold with

the Ascendant; and it thus becomes, as it were, a lunar horoscope or Ascendant."

It is therefore clear that Ptolemy intended degrees of oblique ascension or descension, and not merely degrees in the zodiac, the relations of which, in regard to the horizon of any place, are continually changing.

Thus in the horoscope of Ruskin we have—

| | | | | |
|--------------|----------|---------|----------|----------------------------------|
| O.A. of Sun | . | . | 341° 13' | |
| O.D. of Moon | 157° 26' | | | |
| | add | 180° 0' | 337° 26' | |
| | | | | <hr/> |
| | | | | 3° 47' Moon to oppos. Sun. |
| O.D. of 7th | . | . | 159° 56' | |
| | | | | <hr/> |
| | | | | 156° 9' O.D. of Part of Fortune. |

This gives us a position answering to the 10th degree of Leo, and therefore close to the Moon.

Placidus says: "Let the Sun's oblique ascension taken in the Ascendant be subtracted always from the oblique ascension of the Ascendant, as well in the day as in the night, and the remaining difference be added to the Moon's right ascension; the sum will be the right ascension of the Part of Fortune, which will have the Moon's declination."

In the example horoscope the oblique ascension of the Ascendant is 339° 56', from which take the Sun's oblique ascension 341° 13' (adding 360 for subtraction), and the remainder is 358° 43', which

add to the right ascension of the Moon $120^{\circ} 17'$, and the sum is the right ascension of the Part of Fortune $119^{\circ} 0'$.

The right ascension of the *imaum cæli* being $69^{\circ} 56'$, the meridian distance of the Part of Fortune will be $49^{\circ} 4'$, and its semiarc will be that of the Moon, $52^{\circ} 51'$, as it has the same declination as the Moon in all cases. Then semiarc $52^{\circ} 51' - 49^{\circ} 4' = 3^{\circ} 47'$, which is the same as we derived from the method of Ptolemy. For there we found the oblique descension of the Part of Fortune to be $156^{\circ} 9'$; and the oblique descension of the 7th being $159^{\circ} 56'$, the difference is $3^{\circ} 47'$.

The method of Placidus appears preferable in that we derive at once the right ascension and meridian distance of the Part of Fortune.

The question is, however, whether either is true, and only directions made by the position as thus derived can settle the point in debate.

To enable the student to at once work out the primary arcs, we here append the speculum in the example horoscope :

| R.A. | Ner. Dist. | Semiarc. | Horiz. Arc. | Cusp. Dist. |
|------------------|-----------------|------------------|-----------------|-----------------|
| $119^{\circ} 0'$ | $49^{\circ} 4'$ | $52^{\circ} 51'$ | $3^{\circ} 47'$ | $3^{\circ} 47'$ |

These elements at once suggest that the pole of the Part of Fortune can be found, and direction made by the Part of Fortune in mundo and

zodiac to the planets, just as if it were a definite body.

The fact that it is merely a symbol, a point in space, does not in the least invalidate its significance in human affairs, as some impulsive students have suggested. For what else are the degrees of the zodiac known as the Midheaven and Ascendant ? They are points in space which bear a definite relationship to a particular place at a given time. They do not need to be identified with a star in the heavens in order to obtain a significance in the horoscope. Every tyro in astrology knows as an absolute fact that these points have a very demonstrable significance in a horoscope, and that transits of the major planets over these points, and the passing of these points by planets in direction, are attended by events which leave no shadow of doubt that they are an essential part of the signalling apparatus by which we are forewarned of coming events. And if these, why not the Part of Fortune ? Call it a " myth " if you like, but understand that a myth is a " veil " designed to hide a truth which a symbol is said to embody. The symbol handed down to us is identical with that used in China and also in Egypt to indicate " land, territory, a field."

CHAPTER XIII

LUNAR PARALLAX AND SEMI-DIAMETER

AMONG the problems modernly confronting the student of directional astrology, that of the horizontal parallax of the Moon is perhaps one of the most important and at the same time most perplexing.

The places of the planets as indicated in the horoscope are the geocentric longitudes. They are computed from the standpoint of an observer. But as the place of observation is on the surface of the Earth and not at its centre, the observed position of the Moon will not exactly coincide with its computed geocentric longitude. In the case of the Sun and planets, the distances from the Earth are so great as to render the parallax inconsiderable, that of the Sun being only 9", and the parallaxes of other bodies beyond it being proportionately less. But in regard to the Moon, its nearness to the Earth renders its parallax of importance if we are to regard the Moon as affecting us by its direct ray. The nearer the Earth it may be, the greater is the angle of parallax. It is

therefore greatest at the perigee and least at the apogee of the Moon.

As the amount of parallax depends on the Moon's place in its orbit, we make use of the apogee as a point of departure, and the Moon's distance from that point in its orbit where it is furthest from the Earth is called its anomaly.

By comparing the calculated place with the observed place it has been found that the difference of the two at the apogee is $53' 53''$, and at perigee $61' 23''$. It will be sufficient for our purpose if we call these $54'$ and $61'$ respectively. By the use of the "Ready Reckoner" the amount of the anomaly can always be found for any date or hour, and the corresponding parallax is set against it. The table is here repeated for convenience.

TABLE OF ANOMALY.

Epoch 1800, Jan. 0^d 0^h 0^m = 9^s 20° 20'.

| Years. | Add. | Days. | Add. | Anom. | Hor. Par. |
|-------------|----------------|-------|----------------|------------|-----------|
| | <i>s o ' /</i> | | <i>s o ' /</i> | <i>s o</i> | <i>'</i> |
| 1 | 2 28 43 | 1 | 0 13 4 | 0 0 | 54 |
| 2 | 5 27 27 | 2 | 0 26 8 | 6 | 55 |
| 3 | 8 26 10 | 3 | 1 9 12 | 12 | 55 |
| 4 | 0 7 57 | 4 | 1 22 16 | 18 | 55 |
| 5 | 3 6 40 | 5 | 2 5 19 | 24 | 55 |
| 6 | 6 5 24 | 6 | 2 18 23 | 1 0 | 55 |
| 7 | 9 4 7 | 7 | 3 1 27 | 6 | 55 |
| 8 | 0 15 54 | 8 | 3 14 31 | 12 | 55 |
| 9 | 3 14 38 | 9 | 3 27 35 | 18 | 55 |
| 10 | 6 13 21 | 10 | 4 10 39 | 24 | 56 |
| 20 | 1 9 46 | 11 | 4 23 43 | 2 0 | 56 |
| 40 | 2 19 32 | 12 | 5 6 47 | 6 | 56 |
| 50 | 9 2 53 | 13 | 5 19 51 | 12 | 56 |
| 60 | 3 29 18 | 14 | 6 2 55 | 18 | 57 |
| 70 | 10 12 39 | 15 | 6 15 58 | 24 | 57 |
| 80 | 5 9 3 | 16 | 6 29 2 | 3 0 | 57 |
| 90 | 11 22 24 | 17 | 7 12 6 | 6 | 58 |
| 100 | 6 18 49 | 18 | 7 25 10 | 12 | 58 |
| Months. | Add. | 19 | 8 8 14 | 18 | 59 |
| January . | 0 0 0 | 20 | 8 21 18 | 24 | 59 |
| February . | 1 15 1 | 21 | 9 4 22 | 4 0 | 59 |
| March . | 1 20 50 | 22 | 9 17 26 | 6 | 59 |
| April . | 3 5 51 | 23 | 10 0 30 | 12 | 60 |
| May . | 4 7 48 | 24 | 10 13 34 | 18 | 60 |
| June . | 5 22 49 | 25 | 10 26 37 | 24 | 60 |
| | | 26 | 11 9 41 | 5 0 | 60 |
| July . | 6 24 46 | 27 | 11 22 45 | 6 | 60 |
| August . | 8 9 47 | 28 | 0 5 49 | 12 | 60 |
| September . | 9 24 48 | 29 | 0 18 53 | 18 | 61 |
| October . | 10 26 45 | 30 | 1 1 57 | 24 | 61 |
| November . | 0 11 45 | 31 | 1 15 1 | 6 0 | 61 |
| December . | 1 13 42 | | | | |

Example.—Find the Moon's anomaly for 8th February 1819, and the corresponding horizontal parallax.

| | s | ° | ' |
|------------------|---|----|----|
| Epoch 1800 . . . | 9 | 20 | 20 |
| Add 19 . . . | 9 | 27 | 59 |
| February . . . | 1 | 15 | 1 |
| 8 days . . . | 3 | 14 | 31 |

Anomaly = 0 17 51

The Moon is therefore within 18° of its apogee or furthest distance from the Earth, and its parallax will therefore be near its minimum. Our table shows that the parallax due to this anomaly is $55'$. This would be the difference between the Moon's geocentric longitude and its observed position from the surface of the Earth if it were exactly on the horizon. At the meridian the parallax is 0, and at the horizon it differs, as stated, from $54'$ to $61'$ according to the distance of the Moon from the Earth, *i.e.* its place in its orbit.

Now, as the horizon is at all points 90° from the zenith or nadir, we can make one of these the apex of a triangle, of which the zenith distance of the Moon at transit is the perpendicular and the base its meridian distance. From these we may find the hypotenuse, which will be the Moon's zenith distance at the time of birth.

Thus, in the example horoscope the latitude of the place is $51^\circ 30' \text{ N.}$, and the Moon has latitude

$5^{\circ} 1' N.$, which therefore must be subtracted, leaving $46^{\circ} 29'$ as the zenith distance of the Moon at transit of the nadir. Its meridian distance is found from the speculum to be $50^{\circ} 21'$. Then

| | |
|--------------------------------|-----------|
| Log. cosine $50^{\circ} 21'$. | . 9.80489 |
| Log. cosine $46^{\circ} 29'$. | . 9.83794 |
| | <hr/> |
| Log. cosine $63^{\circ} 52'$. | . 9.64283 |

And as 90° is to $55'$, so is $63^{\circ} 52'$ to $39'$, which is the Moon's parallax, and by which amount she is apparently depressed further below the horizon than she is computed to be. This will affect its meridian distance, etc. The directions of the Moon, if operating dynamically by right lines of energy upon any part of the Earth instead of *via* the centre of the Earth, will hence be affected; and it remains a problem worth some close study and consideration as to what view ought to be taken. It is sufficient here to have indicated the method of calculation. It is one of the factors in the vexed problem of "the uncertain Moon," which has frequently been charged with an inconstancy altogether absent from the directions of the Sun and planets.

The semi-diameters of the Sun and Moon have often been resorted to in order to accommodate a directional arc to the date of an event. Allowing, as is undoubtedly the case, that primary directions have an orb of influence within the limits of which

it may be said they begin to operate, attain their maximum, and pass off, there yet remains the fact that one would naturally expect the maximum to coincide with the most marked phase of a crisis in the life. This appears to be acknowledged, inasmuch as practitioners in the art of directing make use of arcs of direction, measured from the centres of bodies as determined by their longitudes, in order to correct approximate times of birth. This correction can only be legitimately made on the supposition that arcs of direction are close, if not exact, to the time of the events they are held to signify.

And unless there were this fundamental integrity of the system of direction advocated, unless there was a close agreement throughout a life between the arcs of direction and the events portrayed, there would be no use in making the calculations.

Our longitudes are geocentric and apply to the apparent centre of the bodies. The apparent diameter of the larger planets, on account of their great distance from the Earth, is inconsiderable. But when we come to the Sun and Moon, which are the chief significators, and the bodies that are directed to form the aspects of the promittors, we are concerned with orbs that have a visible diameter. The Sun on account of its immense size, and the Moon on account of its close proximity, appear to have a diameter of about half a degree, or from the centre to the limb about $15'$. This becomes an

important consideration when we are directing either of them to the aspect or conjunction of one of the planets, inasmuch as from first to last contact of the disc of the luminary with the said planet or aspect there will be an included arc of half a degree, and this means six months of time according to the Ptolemaic measure of $1^{\circ}=1$ year. Hence it may well be that a direction is increscent for three months before it attains its actual centrality and maximum strength, and another three months may transpire before the effects wear off. And if to this we add the fact that directions formed at the tropics, *i.e.* near Cancer or Capricorn 0, are very slow in formation (as may be seen from the Tables of Declination), 4° of longitude including only $1'$ of declination, it will readily be understood that there is ample room for "latitude" in the timing of events.

It seems desirable, therefore, that a few cases of very well-observed birth-times should be taken, and the arcs of direction computed very closely; and then that these arcs should be compared with the course of events, so that an estimate of the value of the semi-diameters of the Sun and Moon may be made.

The apparent semi-diameter of the Moon is controlled by the same factor as the parallax, namely, its place in the orbit and consequent distance from the Earth. It may be useful to mention that the semi-diameter of the Moon is

approximately twenty-seven one-hundredths of the parallax. Therefore multiply the parallax by 27 and divide by 100. Thus, when the parallax is $54'$, the semi-diameter of the Moon is $54 \times 27 \div 100 = 14\frac{1}{2}'$, and when the parallax is 60, the semi-diameter is $60 \times 27 \div 100 = 16'$.

The Moon directed to the opposition of the Ascendant in the example horoscope works out at $2^{\circ} 30'$; but as the horizontal parallax of the Moon is $55'$, its semi-diameter will be nearly $15'$, and therefore the direction would read :

| | | |
|----------------------------|---------------|------------------------------|
| Asc. oppos. Moon in mundo, | first contact | $2^{\circ} 15'$ |
| „ | „ | middle $2^{\circ} 30'$ |
| „ | „ | last contact $2^{\circ} 45'$ |

thus giving a possible range of $30'$, or six months for the duration of this indication. This may help to account for the variability that has been noticed in regard to lunar directions, and possibly we may also have to consider taking the parallax into account. The solar directions will be affected by semi-diameter of the Sun, but not appreciably by parallax.

CHAPTER XIV

LUNAR EQUATIONS

UNDER this head I propose to examine a problem of some interest which appears to have escaped general recognition, but which may very well be considered with the questions of parallax and semi-diameter as having some connection with the noted irregularity of primary lunar directions.

Take an illustration from the horoscope already submitted. We would direct the Moon to conjunction with the nadir, which direction is known as "Midheaven opposition Moon in mundo." It is measured by the arc of the Moon's meridian distance, $50^{\circ} 21'$, and is formed by the rotation of the Earth on its axis, by which the Moon is carried down the western heavens until it makes its meridian transit.

The theory underlying this direction is that there is a permanent significance and value attaching to the radical positions of the Midheaven, Ascendant, and other significators, which is unaffected by the subsequent changes taking place amongst the planets, either on account of their apparent motions

in the heavens or their real motions in the zodiac. But we have now to consider whether there may not be some value attaching to these subsequent motions of the bodies in the zodiac. These motions, within the narrow limits of time comprised in the formation of directions in a life of ordinary length, would not be appreciable in the case of the planets or the Sun, but in the case of the Moon there would be a quite appreciable increment owing to the velocity of that body in its orbit.

Thus the arc of $50^{\circ} 21'$ cited above would occupy the interval of 3 hours 25 minutes, during which the Moon will have increased its longitude by about $1^{\circ} 42'$, so that it would not actually make the meridian transit for another 7 minutes, although its radical place would then be exactly on the nadir. Its right ascension will be increased by about the same amount, and therefore the actual arc of direction from the time of birth until the bodily transit of the nadir would be about $52^{\circ} 3'$. So far as this case is concerned it is worthy of notice that this arc of the second distance of the Moon to the opposition of the Midheaven, and therefore to the mundane square of the Ascendant, coincided exactly with a period of serious illness and trouble in the life of Ruskin, whereas the arc M.C. opposition Moon in mundo, $50^{\circ} 21'$, exactly coincided with the election of Ruskin to the Slade Professorship of Fine Art, a distinction which brought him into the highest position in his sphere of life.

Obviously, therefore, the second distance of the Moon is by far the most appropriate.

Let us look at another direction from the same point of view. Direct the Moon under its own pole to the opposition of Saturn.

| | |
|---|---------------------|
| The Moon's pole is $47^{\circ} 27'$, and its ascensional difference under that pole, derived in the process of find- ing the pole, is | $31^{\circ} 32'$ |
| Its right ascension | $120^{\circ} 17'$ |
| Its oblique descension under its pole | $151^{\circ} 49'$ |
| Add | $180^{\circ} 0'$ |
| Oblique ascension of opposition Moon | $= 331^{\circ} 49'$ |

Then for Saturn's oblique ascension under the same pole—

Pole of Moon

tang. 10.03712

Tang. Saturn's

decl. 9.08283

Ascl. diff. Saturn

sine $9.11995 = 7^{\circ} 31'$

R.A. of Saturn $348^{\circ} 54'$

O.A. of Saturn $356^{\circ} 25'$ under Moon's
pole.

O.A. of Moon's oppos. $331^{\circ} 49'$

Arc. of Moon oppos. Saturn = $24^{\circ} 36'$

This corresponds with Ruskin's leap into public estimation and fame, for which we have the arc of direction Sun sextile Midheaven in mundo. Most certainly the Moon to opposition Saturn could not be regarded as in the least degree akin to the nature of events then current in the life of the great artist.

But this arc took 1h. 38m. 24s. to complete, and during that time the Moon had increased its R.A. by some $49'$; and as we are bringing Saturn up to the opposition of the Moon under the pole of the Moon, we shall have to curtail the direction by $49'$, which results in an arc of $23^{\circ} 47'$. This is nearly a year in advance of Ruskin's great advent, and may very well have coincided with a period of stress and indisposition.

The Moon to the opposition of Venus comes into force at about thirty years of age, or in the thirtieth year of life, when he married; but by adding the increment due to the time of direction to the radical place of the Moon we get an arc which falls out a whole year later, when it is certain Ruskin realised his disappointment.

The directions of the Sun during the course of sixty years would only be affected by an increment of $10'$, and they can always be relied upon; but the directions of the Moon are at present very unsatisfactory, and it has been thought that this question of second distances may serve not only to indicate why lunar primary directions are inconstant, but why also they appear to have a more

durable influence than those of the Sun. The suggestion is that from the time the direction is formed to the radical position of the Moon to the time that it is formed to the actual position of that body in the heavens, may be the extent of its duration; and during this period, which naturally increases in length as the age increases, transits and other secondary indications may come up repeatedly to reinforce the portents of the lunar direction and bring them into play. Certain it is that there are many conditions affecting the directions of the Moon which arise out of its velocity, and to maintain its ancient reputation for inconstancy and fickleness it appears to have jealously guarded its secret even from the lynx eye of the practical astrologer. Whether we have succeeded in compassing the fickle goddess by this exposition remains to be decided by constant experiment conducted by several independent workers. In the cause of a scientific astrology this is worth carrying out, and it is to be hoped that qualified and unprejudiced students will communicate their experience.

It may assist the average student to know that all directions of the Moon to *succeedent* places will fall out sooner, while those to *precedent* places will fall out later, than indicated by the radical or first distance of the Moon, and the arc of direction must therefore be increased or decreased at the rate of 2' for every degree of the arc of direction. Thus an arc of $39^{\circ} 15'$ requires $1^{\circ} 18\frac{1}{2}'$.

CHAPTER XV

CUSPAL DISTANCES

WHEN giving instructions as to the method of directing bodies to aspects of the Ascendant and Midheaven in mundo, it is customary to affirm that one-third of a planet's semiarc is equal to a house-space, so that a planet that is one-third of its semiarc above the horizon is held to be on the cusp of the 12th house, and when two-thirds of its semiarc above the horizon it is on the cusp of the 11th. But if this were actually the case, we should find that when on the cusp of a house the oblique ascension of an ascending planet is the same as the oblique ascension of the cusp of that house. Such is not the case.

Example.—Direct the Sun in Ruskin's horoscope to the sextile of the Midheaven in mundo. This aspect falls on the cusp of the 12th house.

The semiarc diurnal of the Sun is $69^{\circ} 59'$, and one-third of this is $23^{\circ} 20'$, to which add the Sun's distance under the horizon, $1^{\circ} 17'$, and we get the arc of direction $= 24^{\circ} 37'$. The Sun is then on the cusp of the 12th house presumably. Let us see.

The R.A. of the Midheaven is $249^{\circ} 56'$, to which if we add 60 we shall have the oblique ascension of the cusp of the 12th house, $309^{\circ} 56'$. Now, when the R.A. of the Midheaven is increased by an arc of $24^{\circ} 37'$, the oblique ascension of the cusp of the 12th will be increased by the same amount, and will then be $334^{\circ} 33'$, while the oblique ascension of the Sun is $341^{\circ} 13'$. Wherein lies the error ?

It lies in the fact that we are directing the Sun under the pole of the Ascendant, whereas we should direct it under the pole of the 12th house cusp. I here give a table of the polar elevation due to the various houses in several latitudes, from which, by proportion of their parts, we may derive the pole of any house for any minute of the included latitudes.

POLES OF HOUSES.

| Lat. | Cusps of 3, 5, 9, 11. | Cusps of 2, 6, 8, 12. |
|------|-----------------------|-----------------------|
| 45 | 18 57 | 34 11 |
| 46 | 19 37 | 35 10 |
| 47 | 20 19 | 36 10 |
| 48 | 21 2 | 37 10 |
| 49 | 21 46 | 38 12 |
| 50 | 22 33 | 39 15 |
| 51 | 23 21 | 40 19 |
| 52 | 24 12 | 41 24 |
| 53 | 25 5 | 42 31 |
| 54 | 26 1 | 43 39 |
| 55 | 26 59 | 44 48 |

The pole of the 12th house for the latitude $51^{\circ} 30'$ N. is seen to be $40^{\circ} 51'$, and if we direct the Sun under this pole we shall have the

| | | | |
|----------------------------------|---|---|-------------------|
| Ascensional difference of Sun | | | |
| under pole of 12th | . | . | $13^{\circ} 36'$ |
| Right ascension of Sun | . | . | $321^{\circ} 12'$ |
| <hr/> | | | |
| Oblique ascension of Sun under | | | |
| pole of 12th | . | . | $334^{\circ} 48'$ |
| Oblique ascension of cusp of the | | | |
| 12th house . | . | . | $309^{\circ} 56'$ |
| <hr/> | | | |
| Arc of direction | . | . | $24^{\circ} 52'$ |

This, although not exact, is certainly nearer, and seems to justify the method of directing under the poles of planets.

The fact, however, is that if we take a fixed pole for any house in a given latitude we shall always be in some degree of error, and for the simple reason that the semiarcs of the planets, being parallel to the equator, do not lie in the same plane as the prime vertical, which is the circle we divide into twelve equal parts to form the houses of the heavens. Therefore an equal division of the prime vertical will not result in an equal division of the semiarcs, and either we have to consider the poles of the houses as movable, or, as seems more consistent with the facts, we must regard the house-spaces as unequal. In other words, we shall find that the

time (measured by degrees of R.A.) that the Sun remains in successive houses is unequal, and the same is to be said of any other body. When, therefore, we take one-third of the semicircle of a planet as equal to one house-space, we are indulging in a free use of the metaphysical concept that "all circles are equal to one another," as defined by the doctrine of Correspondences. Against this I have nothing to say except that it is not mathematics.

Now, just as we take the Sun's oblique ascension under the pole of the Ascendant in order to find its distance from the horizon, so we must take its oblique ascension under the pole of the 12th house in order to find its distance from the cusp of the 12th, and its oblique ascension under the pole of the 11th to find its distance from the cusp of the 11th. Its right distance from the cusp of the 10th will be its arc to that cusp, since the meridian has no polar elevation. Thus :

| | | |
|------------------------------|---|---------|
| The pole of the Ascendant is | . | 51° 30' |
| The pole of the 12th house . | . | 40° 51' |
| The pole of the 11th house . | . | 23° 46' |

The Sun's declination is 15° 13', log. tang. 9.64380, and if to this we add the tangent of the poles of the houses successively we shall have the sine of the ascensional differences of the Sun under these poles, which, added to its right ascension, will give its oblique ascension under those poles. These are :

| | |
|---------------------------------------|----------|
| O.A. of Sun under pole of 1st house . | 341° 13' |
| O.A. of Sun under pole of 12th house | 334° 48' |
| O.A. of Sun under pole of 11th house | 327° 59' |
| R.A. of Sun under pole of 10th house | 321° 12' |

Then, to find the arc of direction between the Sun and any of these cusps, we merely subtract the oblique ascension of the one from the other. The oblique ascensions of the cusps are :

| | |
|-----------------------|----------|
| Of the Ascendant . | 339° 56' |
| Of the 12th . | 309° 56' |
| Of the 11th . | 279° 56' |
| Of the Midheaven R.A. | 249° 56' |

Thus we have the following true arcs of direction of the Sun in mundo :

| | |
|----------------------------------|----------|
| O.A. Sun under pole of Ascendant | 341° 13' |
| O.A. of the Ascendant | 339° 56' |

Arc of Sun to conjunction Ascendant 1° 17'

| | |
|----------------------------------|----------|
| O.A. of Sun under pole of 12th . | 334° 48' |
| O.A. of 12th house cusp . | 309° 56' |

Arc of Sun to sextile Midheaven mundo 24° 52'

| | |
|----------------------------------|----------|
| O.A. of Sun under pole of 11th . | 327° 59' |
| O.A. of cusp of 11th . | 279° 56' |

Arc of Sun to sextile Ascendant mundo 48° 3'

| | |
|------------------------------|----------|
| R.A. of Sun under Meridian . | 321° 12' |
| R.A. of Midheaven . | 249° 56' |

71° 16'

And in all these cases the Sun will have the same oblique ascension as the cusp of the house to which it is directed, at the time of direction being completed. This is what we argue for and obtain.

Also we may find the degrees of R.A. which pass under the meridian while the Sun passes from the cusp of one house to the next, and thus the house-space of the Sun at its present declination.

As the whole diurnal arc of the Sun is less than 90, the house-space will be less than 30°.

Subtract the arc of direction of Sun conjunct Ascendant from the arc of direction Sun conjunct 12th = Sun sextile Midheaven. There remains 23° 35', the house-space of 12th house.

Subtract the direction of the Sun to the 12th from that to the 11th; there remains 23° 11', the house-space of the Sun in the 11th. Subtract the arc of direction Sun cusp of the 11th from the Sun conjunct Midheaven; there remains 23° 13', the house-space of the Sun in the 10th.

And the three house-spaces added together = 69° 59', which is the diurnal semiarc of the Sun.

Hence it appears that the mundane directions of planets must be taken in terms of the pole of the cusp to which they are directed. The cuspal distances of the planets must also be measured according to the same rule. This will affect all directions calculated by primary arcs on the semi-arc method now commonly in vogue.

But what appears of most vital importance as

a legitimate conclusion drawn from this critique is that the correct method of directing to any body is by oblique ascension under the pole of that body, which is quite different from taking the direction under the pole of the body directed. At the same time, it appears to dispose of the semiarc method, except as a valuable approximation. For nothing can be more certain than that the cusps of the houses, measured in the prime vertical, are 30° distant from one another by oblique ascension.

These conclusions agree entirely with our mathematics, for we have seen that the house-space of the Sun in the 12th, due to its declination, is $23^\circ 35'$; and if to this we add the Sun's direction (from below) to the Ascendant $= 1^\circ 17'$, we have an arc of direction, Sun to conjunction cusp of 12th = Midheaven sextile Sun in mundo, $24^\circ 52'$, which is exactly what we found the direction of the Sun to be by oblique ascension when taken under the pole of the 12th house.

This proves, if anything can, not only that the correct method of directing is under the pole of the planet or position directed to, but also that the house-spaces are variable and depend on the several declinations of the planets, and thus on their oblique ascensions and descensions, taken under the poles of the successive houses.

By the semiarc method, taking one-third of a semiarc as equal to a house-space, we are dealing with an approximation which, although useful

and facile, is not mathematically correct. Rather than that bad habits should become popular, I have undertaken a somewhat lengthy demonstration of this point, which I consider to be now settled beyond further debate.

CHAPTER XVI

SUGGESTED METHOD OF TRUE DIRECTING

As the result of this examination of the various methods of directing, both by semiarc proportions and by oblique ascensions under the poles, we may come to the conclusion that all the disparities which vitiate the present methods can be disposed of if we proceed along the lines to which our conclusions point. For this purpose we shall require a speculum containing :

1. The right ascension of a planet.
2. Its declination.
3. Its pole.
4. Its ascensional difference under its own pole.

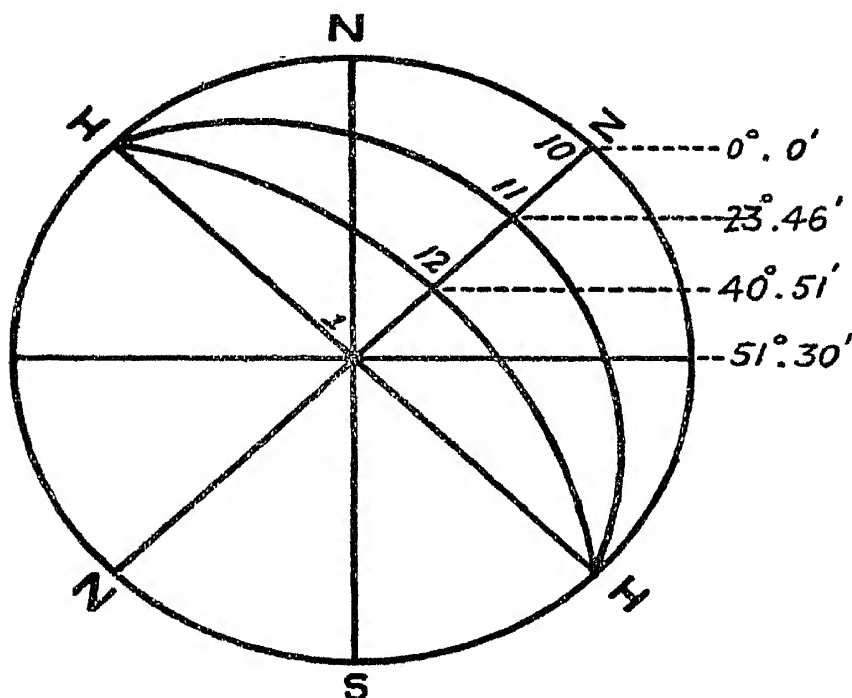
The first of these will, of course, be worked as usual. The declination will be that given in the ephemeris. The pole of the planet will be that derived in the usual way from the ascensional difference of its proportional place in the prime vertical taken under its own declination, as already shown. Its cuspal distance will be the difference between its oblique

ascension (or descension) taken under the pole of the cusp to which it is nearest and the oblique ascension of the cusp in the prime vertical. These are all the elements required for a complete calculation of all legitimate arcs of direction.

Directions must be made under the pole of the body to which we are directing another. The pole is the same as geographical latitude. It represents the latitude (geographical) or polar elevation (astronomical) at which the cusp of the house cuts into the circle of the prime vertical, or at which a circle of position cuts into it.

Thus in the following diagram let the great circle NZHS, etc., be the sphere of the Earth, of which N is the north pole, S the south pole. Also let ZN be the great circle of the prime vertical at an elevation from the Equator of $51^{\circ} 30'$ N., and H-H the horizon intersecting it at right angles. Then HNZH will be the upper meridian and HSNH will be the lower meridian, the points Z and N marking the zenith and the nadir. The cusps of the 10th, 11th, and 12th houses are shown by the great circles cutting through the prime vertical at different elevations, and these answer exactly to the geographical latitudes (north) of the same values. Thus the pole of the Ascendant is $51^{\circ} 30'$, that of the 12th, $40^{\circ} 51'$, that of the 11th, $23^{\circ} 46'$, and that of the 10th, $0^{\circ} 0'$, as shown in the diagram, the ascensional difference being the arc in R.A. between N-S and H-H.

A circle of position is thus seen to be one which passes through a body and converges upon the



horizon north and south exactly like an intermediate cusp of a house.

Rules for Directing

Rule 1.—Find the pole of the body or ecliptic position to which direction is to be made. Find the ascensional difference under this pole of the body to be directed. Apply this ascensional difference to the right ascension of the body to be directed, and obtain its oblique ascension (or descension, as the case may require) under the

pole of the body to which direction is made. The difference between this and the oblique ascension of the body to which direction is made, taken under its own pole, will be the *arc of direction*.

Rule 2.—In mundane directions take the body of the promittor, *i.e.* body directed to. In zodiacal directions take its longitude.

Rule 3.—In directing to the aspect of a planet in mundo, its cuspal distance taken under its own pole must be directed to under the same pole.

This rule also serves for mundane parallels.

Here is the Speculum required for Ruskin's horoscope.

SPECULUM

| Planet. | R.A. | Declin. | Pole. | Ascen. Diff. |
|---------------|--------|------------------|-------------------|--------------|
| Sun . . . | 321 12 | 15 13 9-43458 | 51 13 10-09493 | 19 47 |
| Moon . . . | 120 17 | 25 39 9-68142 | 50 21 10-08147 | 35 24 |
| Mercury . . . | 296 47 | 21 34 9-59688 | 44 55 9-99885 | 23 13 |
| Venus . . . | 276 6 | 18 10 9-51606 | 27 13 9-71125 | 9 43 |
| Mars . . . | 299 6 | 21 45 9-60013 | 46 22 10-02066 | 24 44 |
| Jupiter . . . | 302 37 | 20 26 9-57119 | 47 13 10-03355 | 23 44 |
| Saturn . . . | 348 54 | 6 54 9-08283 | 45 56 10-01423 | 7 11 |
| Uranus . . . | 262 49 | 23 24 9-63623 | 3 13 8-74904 | 7 27 |
| Neptune . . . | 267 47 | 22 14 9-61148 | 3 48 8-82147 | 9 20 |

Examples

Direct the Sun in mundo to the conjunction with Venus mundo. The pole of Venus is $27^{\circ} 13'$, its ascensional difference under that pole is $9^{\circ} 43'$, which added to its R.A., $276^{\circ} 6'$ (as Venus' declination is S.), gives its oblique ascension under its own pole = $285^{\circ} 49'$.

The oblique ascension of Sun under the same pole is—

| | | |
|--------------------|------------------|---------|
| Pole, log. tang. . | $27^{\circ} 13'$ | 9.71125 |
|--------------------|------------------|---------|

| | | |
|---------------------|------------------|---------|
| Decl., log. tang. . | $15^{\circ} 13'$ | 9.43458 |
|---------------------|------------------|---------|

| | | |
|----------------------|----------------|---------|
| Asc. diff. log. sine | $8^{\circ} 2'$ | 9.14583 |
|----------------------|----------------|---------|

| | | |
|---------------|-------------------|--|
| R.A. of Sun . | $321^{\circ} 12'$ | |
|---------------|-------------------|--|

| | | |
|---------------|-------------------|--------------------|
| O.A. of Sun . | $329^{\circ} 14'$ | under Venus' pole. |
|---------------|-------------------|--------------------|

| | | |
|--------------|-------------------|-------|
| O.A. Venus . | $285^{\circ} 49'$ | „ „ „ |
|--------------|-------------------|-------|

Arc of direction = $43^{\circ} 25'$ Sun conj. Venus in mun.

Note.—All the tangents being inserted in the speculum under the declinations and poles of the planets, they can be extracted as required.

Direct Uranus to the conjunction with the Moon in mundo.

The pole of the Moon is $50^{\circ} 21'$, its ascensional difference under that pole is $35^{\circ} 24'$, and its oblique descension $155^{\circ} 41'$.

| | | |
|--------------------------|---------|--------------|
| The declin. of Uranus is | 23° 24' | tan. 9.63623 |
| Pole of Moon | 50° 21' | tan. 0.08147 |

| | | |
|-----------------------|----------|--------------|
| Asc. diff. under pole | 31° 28' | sine 9.71770 |
| Uranus' R.A. | 262° 49' | |

| | | |
|---------------|----------|--------------------|
| O.D. Uranus | 231° 21' | under Moon's pole. |
| O.D. of Moon. | 155° 41' | „ „ „ |

Arc of direction = 75° 40' Uranus conj. Moon
in mundo.

These directions take very much less time to calculate than to set out in writing, and with the speculum at hand they are readily figured out in a minute or two.

Direct the Moon to opposition of Venus in mundo.

Oblique descension of the opposition of Venus = 105° 49'.

This is taken under the pole of Venus, from Venus' oblique ascension less 180° = oblique ascension of the opposite point.

| | |
|---|----------|
| Oblique descension of Moon under Venus' | |
| pole | 134° 37' |
| Oblique descension of Venus under same | |
| pole | 105° 49' |

| | |
|-------------------------------------|---------|
| Arc of Direction, Moon oppos. Venus | |
| mundo | 28° 48' |

These examples will doubtless serve for all conjunctions in mundo. For zodiacal directions it will be necessary to find the declination of the degree of the ecliptic held by a planet to which direction is made, or of its aspect, and add the log. tang. of this declination to the log. tang. of its pole. This will give the ascensional difference under that pole. Apply this to the right ascension to get its oblique ascension or oblique descension under that pole. The difference between this and the oblique ascension (or descension) of the planet directed, taken under the same pole, will be the arc of direction.

Planets having the same pole are either in mundane conjunction or in mundane parallel. This gives us the hint as to the calculation of mundane parallels.

Find the oblique ascension or oblique descension of the planet on which the parallel is formed, taken under its own pole. Find the oblique ascension or oblique descension (as the case may require) of the planet forming the parallel, under the same pole. The difference will be the arc of direction.

Example 1. — Bring Saturn in the example horoscope to the mundane parallel of the Moon.

This direction is formed by Saturn coming up to the pole of the Moon on the other side of the meridian.

| | |
|--|----------|
| Right ascension of the Midheaven . | 249° 56' |
| Oblique descension of Moon under its own pole | 155° 45' |
| Moon's distance from Midheaven, westward | 94° 11' |
| Added to R.A. of M.C. . | 249° 56' |
| Oblique ascension of the parallel, eastward | 344° 7' |
| Oblique ascension of Saturn under Moon's pole | 357° 18' |
| Arc of direction = difference . | 13° 11' |

This arc of direction, when computed by the semiarc method, is seen to be 8' short of the actual figures, which throws the time out nearly two months. The arc by that method is 13° 3' as compared with 13° 11', the true arc.

Example 2.—Bring Uranus to the mundane parallel of Sun in mundo. Here the planet descends the western horizon until it comes to the same pole westward as the Sun holds eastward.

| | |
|---|----------|
| Oblique ascension of the Sun under its own pole, 51° 13' | 340° 59' |
| Subtract 180 | 180° 0' |
| Oblique descension of aspect below west horizon | 160° 59' |
| Oblique descension of Uranus under pole of Sun | 230° 14' |
| Arc of direction, Uranus parallel Sun mundo | 69° 15' |

This arc of direction by the semiarc method is found to be $70^{\circ} 57'$, which shows an error of $1^{\circ} 42'$, equal to one year and eight months of time.

Time Measure for Arcs

This remark brings me back again to the question of the equation of time, so much in dispute among astrologers. I think there can be little doubt that the true method is "a day for a year," which is certainly the most ancient method, as it is also the most uniform. In twenty-four hours the Earth revolves on its axis and the Sun comes again to the same meridian, having in the interval increased its longitude by more or less than a degree according to its apparent place in its orbit, *i.e.* the season of the year. The mean rate of its motion is $59' 8''$. Then, as all our calculations are made in terms of equatorial degrees, we have to make a proportion $59' 8''$ to $60'$, and this gives $24\text{h. } 21\text{m.} = 1 \text{ year } 5.334 \text{ days} = 1 \text{ year } 5\text{d. } 8\text{h.}$ for each 1° in the arc of direction. Thus every 6° in the arc of direction will give an extra month, to be added to the time at the rate of $1^{\circ} = 1 \text{ year}$, which is the measure of time used in the semiarc method. If we add $5'$ for every 6° of arc it will come to the same thing approximately. The measure of a degree of R.A. for a year is due to Placidus. That of the Sun's mean motion, or $1^{\circ} \text{ R.A.} = 1 \text{ year } 5 \text{ days}$, is due to Valentine Naibod. Both are a compromise with facts. The probability is that we ought to

take the measure according to the season of the year in which the birth takes place, and hence the Sun's actual increase of R.A. on that date, since the Sun is in every natural sense the great chronocrater, or time-maker. Thus, in the case of Ruskin, who was born on the 8th February, the Sun's diurnal increase of R.A. is $3' 57'' = 59' 15''$ in arc, but its increase in longitude is $60' 43''$, and this being an excess $1' 35''$ over the mean motion in the zodiac, an arc of direction, at the rate of a day for a year, would measure to so much less, at the rate of about $1\frac{1}{2}$ minutes for every complete degree of the arc. It will thus be seen that the question of the validity of one method over another in primary directions does not rest entirely on the astronomical facts, but also upon the value we attach to the arcs of direction when obtained. As to the astronomy of the case, there is not the slightest doubt in my mind that the method of directing under the pole of the significator is the correct mathematical scheme. But as to the measure of time from arcs thus derived, this is a matter of experiment, and one needs to exhaust all the evidence before coming to a conclusion.

CHAPTER XVII

CONCLUSION

IN the foregoing pages I have endeavoured to set out and critically examine the methods of directing advocated by Ptolemy and Placidus as modernly represented ; and I have further sought to establish their validity on general principles. I have not been blind to their imperfections, and have clearly indicated my view of the semiarc method, derived from the principles laid down by these great pioneers of a scientific astrology, when I speak of them as valuable approximations. The discrepancies are those due to incorrect use of words in describing the facts. The term "corresponding to " should be more frequently used in the semiarc method in place of the term "equal to." It is admitted that in both systems—that of proportional semiarcs and that of direction under poles—we are concerned with the apparent places of the planets in the prime vertical, and therefore when we speak of planets as being directed to a conjunction we mean an apparent conjunction as seen from the place of birth, and not either in the zodiac or by

right ascension, but solely in the prime vertical or circle of observation, which coincides neither with the Equator nor the Ecliptic. Therefore, when we come to the test we find without doubt that the only way of doing this is to bring the directed body along its own arc or parallel of declination to the same pole as the promittor or body directed to. Also, it is apparent that as polar elevation is measured from the zenith in the plane of the prime vertical, planets having the same pole must be in mundane conjunction if on the same side of the meridian, or in mundane parallel if on opposite sides, which fact renders the calculation of mundane parallels a process of such extreme simplicity that I wonder it has never been pointed out before.

To correct the errors arising out of the methods of Ptolemy and Placidus, I have made a complete statement of the true doctrine of polar directions in the plane of the prime vertical, and have supplemented this by a speculum drawn according to the principles laid down, so that by mere inspection of the same, and very little figuring, all directions in mundo can be calculated. For directions in the zodiac it will be necessary to have the pole of the aspect or position in the zodiac, which can be determined by the longitudinal distance from the cusp of the house taken in proportion to the degrees of the ecliptic included in that house from the Table of Poles of the Houses, and from this we get its oblique ascension or oblique de-

scension under its own pole, and direct to it as in mundane direction.

In effect, it will be found that with a set of tables of oblique ascension, and one of tables of poles, all directions can be correctly calculated in a fraction of the time usually devoted to them, even by the very facile but faulty method of proportion of semi-arcs. I have fairly stated both cases, and criticised only where criticism was necessary to correct error. In this I have done no hurt to the cause of scientific astrology, and I conclude this treatise in the earnest belief that I have even done some small service.

TABLES FOR THE USE OF ASTROLOGICAL STUDENTS

INCLUDING TABLES OF LOGARITHMIC
SINES, TANGENTS, ETC., TABLES OF
RIGHT ASCENSION, DECLINA-
TION, AND ASCENSIONAL
DIFFERENCE, AND TER-
NARY PROPORTIONAL
LOGARITHMS

TABLES OF LOGARITHMIC
SINES, TANGENTS, ETC.

[0 degrees.]

| | Sine. | Diff. | Tangent. | Diff. | Cotang. | Cosine. | |
|----|---------|-------|----------|-------|----------|---------|----|
| 0 | — ∞ | — ∞ | — ∞ | ∞ | + ∞ | 0.00000 | 60 |
| 1 | 6.46373 | 30103 | 6.46373 | 30103 | 13.53627 | 0.00000 | 59 |
| 2 | 6.76476 | 17609 | 6.76476 | 17609 | 13.23524 | 0.00000 | 58 |
| 3 | 6.94085 | 12494 | 6.94085 | 12494 | 13.05915 | 0.00000 | 57 |
| 4 | 7.06579 | 9691 | 7.06579 | 9691 | 12.93421 | 0.00000 | 56 |
| 5 | 7.16270 | 7918 | 7.16270 | 7918 | 12.83730 | 0.00000 | 55 |
| 6 | 7.24188 | 6694 | 7.24188 | 6694 | 12.75812 | 0.00000 | 54 |
| 7 | 7.30882 | 5800 | 7.30882 | 5800 | 12.69118 | 0.00000 | 53 |
| 8 | 7.36682 | 5115 | 7.36682 | 5115 | 12.63318 | 0.00000 | 52 |
| 9 | 7.41797 | 4576 | 7.41797 | 4576 | 12.58203 | 0.00000 | 51 |
| 10 | 7.46373 | 4139 | 7.46373 | 4139 | 12.53627 | 0.00000 | 50 |
| 11 | 7.50512 | 3779 | 7.50512 | 3779 | 12.49488 | 0.00000 | 49 |
| 12 | 7.54291 | 3476 | 7.54291 | 3476 | 12.45709 | 0.00000 | 48 |
| 13 | 7.57667 | 3218 | 7.57667 | 3219 | 12.42233 | 0.00000 | 47 |
| 14 | 7.60885 | 2997 | 7.60885 | 2996 | 12.39014 | 0.00000 | 46 |
| 15 | 7.63982 | 2802 | 7.63982 | 2803 | 12.36018 | 0.00000 | 45 |
| 16 | 7.66784 | 2633 | 7.66784 | 2633 | 12.33215 | 0.00000 | 44 |
| 17 | 7.69417 | 2483 | 7.69418 | 2482 | 12.30582 | 0.00000 | 43 |
| 18 | 7.71900 | 2348 | 7.71900 | 2348 | 12.28100 | 0.00000 | 42 |
| 19 | 7.74248 | 2227 | 7.74248 | 2228 | 12.25752 | 0.00000 | 41 |
| 20 | 7.76475 | 2119 | 7.76476 | 2119 | 12.23524 | 0.00000 | 40 |
| 21 | 7.78594 | 2021 | 7.78595 | 2020 | 12.21405 | 0.00000 | 39 |
| 22 | 7.80615 | 1930 | 7.80615 | 1931 | 12.19385 | 0.00000 | 38 |
| 23 | 7.82545 | 1848 | 7.82546 | 1848 | 12.17454 | 0.00000 | 37 |
| 24 | 7.84393 | 1773 | 7.84394 | 1773 | 12.15606 | 0.00000 | 36 |
| 25 | 7.86166 | 1704 | 7.86167 | 1704 | 12.13833 | 0.00000 | 35 |
| 26 | 7.87870 | 1639 | 7.87871 | 1639 | 12.12129 | 0.00000 | 34 |
| 27 | 7.89509 | 1579 | 7.89510 | 1579 | 12.10490 | 0.00000 | 33 |
| 28 | 7.91088 | 1524 | 7.91089 | 1524 | 12.08911 | 0.00000 | 32 |
| 29 | 7.92612 | 1472 | 7.92613 | 1473 | 12.07387 | 0.00000 | 31 |
| 30 | 7.94084 | | 7.94086 | | 12.05914 | 0.00000 | 30 |
| | | | Cotang. | | Tangent. | Sine. | |

[89 degrees.]

[0 degrees.]

| | Sine. | Diff. | Tangent. | Diff. | Cotang. | Cosine. | |
|----|---------|-------|----------|-------|----------|---------|----|
| 30 | 7.94084 | 1424 | 7.94086 | 1424 | 12.05914 | 0.99998 | 30 |
| 31 | 7.95508 | 1379 | 7.95510 | 1379 | 12.04490 | 0.99998 | 29 |
| 32 | 7.96887 | 1336 | 7.96889 | 1336 | 12.03111 | 0.99998 | 28 |
| 33 | 7.98223 | 1297 | 7.98225 | 1297 | 12.01775 | 0.99998 | 27 |
| 34 | 7.99520 | 1259 | 7.99522 | 1259 | 12.00478 | 0.99998 | 26 |
| 35 | 8.00779 | 1223 | 8.00781 | 1223 | 11.99219 | 0.99998 | 25 |
| 36 | 8.02002 | 1190 | 8.02004 | 1190 | 11.97996 | 0.99998 | 24 |
| 37 | 8.03192 | 1158 | 8.03194 | 1158 | 11.96806 | 0.99997 | 23 |
| 38 | 8.04350 | 1128 | 8.04353 | 1128 | 11.95647 | 0.99997 | 22 |
| 39 | 8.05478 | 1100 | 8.05481 | 1100 | 11.94519 | 0.99997 | 21 |
| 40 | 8.06578 | 1072 | 8.06581 | 1072 | 11.93419 | 0.99997 | 20 |
| 41 | 8.07650 | 1046 | 8.07653 | 1047 | 11.92347 | 0.99997 | 19 |
| 42 | 8.08696 | 1022 | 8.08700 | 1022 | 11.91300 | 0.99997 | 18 |
| 43 | 8.09718 | 999 | 8.09722 | 998 | 11.90278 | 0.99997 | 17 |
| 44 | 8.10717 | 976 | 8.10720 | 976 | 11.89280 | 0.99996 | 16 |
| 45 | 8.11693 | 954 | 8.11696 | 955 | 11.88304 | 0.99996 | 15 |
| 46 | 8.12647 | 934 | 8.12651 | 934 | 11.87349 | 0.99996 | 14 |
| 47 | 8.13581 | 914 | 8.13585 | 915 | 11.86415 | 0.99996 | 13 |
| 48 | 8.14495 | 896 | 8.14500 | 895 | 11.85500 | 0.99996 | 12 |
| 49 | 8.15391 | 877 | 8.15395 | 878 | 11.84605 | 0.99996 | 11 |
| 50 | 8.16268 | 860 | 8.16273 | 860 | 11.83727 | 0.99995 | 10 |
| 51 | 8.17128 | 843 | 8.17133 | 843 | 11.82867 | 0.99995 | 9 |
| 52 | 8.17971 | 827 | 8.17976 | 828 | 11.82024 | 0.99995 | 8 |
| 53 | 8.18798 | 812 | 8.18804 | 812 | 11.81196 | 0.99995 | 7 |
| 54 | 8.19610 | 797 | 8.19616 | 797 | 11.80384 | 0.99995 | 6 |
| 55 | 8.20407 | 782 | 8.20413 | 782 | 11.79587 | 0.99994 | 5 |
| 56 | 8.21189 | 769 | 8.21195 | 769 | 11.78805 | 0.99994 | 4 |
| 57 | 8.21958 | 755 | 8.21964 | 756 | 11.78036 | 0.99994 | 3 |
| 58 | 8.22713 | 743 | 8.22720 | 742 | 11.77280 | 0.99994 | 2 |
| 59 | 8.23456 | 730 | 8.23462 | 730 | 11.76538 | 0.99994 | 1 |
| 60 | 8.24186 | | 8.24192 | | 11.75808 | 0.99993 | 0 |
| | | | Cotang. | | Tangent. | Sine. | |

[89 degrees.]

[1 degree.]

| ' | Sine. | Diff. | Tangent. | Diff. | Cotang. | Cosine. | ' |
|----|---------|-------|----------|-------|----------|---------|----|
| 0 | 8.24186 | 717 | 8.24192 | 718 | 11.75808 | 9.99993 | 60 |
| 1 | 8.24903 | 706 | 8.24910 | 706 | 11.75990 | 9.99993 | 59 |
| 2 | 8.25609 | 695 | 8.25616 | 696 | 11.74384 | 9.99993 | 58 |
| 3 | 8.26304 | 684 | 8.26312 | 684 | 11.73688 | 9.99993 | 57 |
| 4 | 8.26988 | 673 | 8.26996 | 673 | 11.73004 | 9.99992 | 56 |
| 5 | 8.27661 | 663 | 8.27669 | 663 | 11.72331 | 9.99992 | 55 |
| 6 | 8.28324 | 653 | 8.28332 | 654 | 11.71668 | 9.99992 | 54 |
| 7 | 8.28977 | 644 | 8.28986 | 643 | 11.71014 | 9.99992 | 53 |
| 8 | 8.29621 | 634 | 8.29629 | 634 | 11.70371 | 9.99992 | 52 |
| 9 | 8.30255 | 624 | 8.30263 | 625 | 11.69737 | 9.99991 | 51 |
| 10 | 8.30879 | 616 | 8.30888 | 617 | 11.69112 | 9.99991 | 50 |
| 11 | 8.31495 | 608 | 8.31505 | 607 | 11.68495 | 9.99991 | 49 |
| 12 | 8.32103 | 599 | 8.32112 | 599 | 11.67888 | 9.99990 | 48 |
| 13 | 8.32702 | 590 | 8.32711 | 591 | 11.67289 | 9.99990 | 47 |
| 14 | 8.33292 | 583 | 8.33302 | 584 | 11.66698 | 9.99990 | 46 |
| 15 | 8.33875 | 575 | 8.33886 | 575 | 11.66114 | 9.99990 | 45 |
| 16 | 8.34450 | 568 | 8.34461 | 568 | 11.65539 | 9.99989 | 44 |
| 17 | 8.35018 | 560 | 8.35029 | 561 | 11.64971 | 9.99989 | 43 |
| 18 | 8.35578 | 553 | 8.35590 | 553 | 11.64410 | 9.99989 | 42 |
| 19 | 8.36131 | 547 | 8.36143 | 546 | 11.63857 | 9.99989 | 41 |
| 20 | 8.36678 | 539 | 8.36689 | 540 | 11.63311 | 9.99988 | 40 |
| 21 | 8.37217 | 533 | 8.37229 | 533 | 11.62771 | 9.99988 | 39 |
| 22 | 8.37750 | 526 | 8.37762 | 527 | 11.62238 | 9.99988 | 38 |
| 23 | 8.38276 | 520 | 8.38289 | 520 | 11.61711 | 9.99987 | 37 |
| 24 | 8.38796 | 514 | 8.38809 | 514 | 11.61191 | 9.99987 | 36 |
| 25 | 8.39310 | 508 | 8.39323 | 509 | 11.60677 | 9.99987 | 35 |
| 26 | 8.39818 | 502 | 8.39832 | 502 | 11.60168 | 9.99986 | 34 |
| 27 | 8.40320 | 496 | 8.40334 | 496 | 11.59666 | 9.99986 | 33 |
| 28 | 8.40816 | 491 | 8.40830 | 491 | 11.59170 | 9.99986 | 32 |
| 29 | 8.41307 | 485 | 8.41321 | 486 | 11.58679 | 9.99985 | 31 |
| 30 | 8.41792 | | 8.41807 | | 11.58193 | 9.99985 | 30 |
| ' | Cosine. | | Cotang. | | Tangent. | Sine. | ' |

[88 degrees.]

[1 degree.]

| ' | Sine. | Diff. | Tangent. | Diff. | Cotang. | Cosine. | ' |
|----|---------|---------|----------|-------|----------|---------|----|
| 30 | 8.41792 | 480 | 8.41807 | 480 | 11.58193 | 9.99985 | 30 |
| 31 | 8.42272 | 474 | 8.42287 | 475 | 11.57713 | 9.99985 | 29 |
| 32 | 8.42746 | 470 | 8.42762 | 470 | 11.57238 | 9.99984 | 28 |
| 33 | 8.43216 | 464 | 8.43232 | 464 | 11.56768 | 9.99984 | 27 |
| 34 | 8.43680 | 459 | 8.43696 | 460 | 11.56304 | 9.99984 | 26 |
| 35 | 8.44139 | 455 | 8.44156 | 455 | 11.55844 | 9.99983 | 25 |
| 36 | 8.44594 | 450 | 8.44611 | 450 | 11.55389 | 9.99983 | 24 |
| 37 | 8.45044 | 445 | 8.45061 | 446 | 11.54939 | 9.99983 | 23 |
| 38 | 8.45489 | 441 | 8.45507 | 441 | 11.54493 | 9.99982 | 22 |
| 39 | 8.45930 | 436 | 8.45948 | 437 | 11.54052 | 9.99982 | 21 |
| 40 | 8.46366 | 433 | 8.46385 | 432 | 11.53615 | 9.99982 | 20 |
| 41 | 8.46799 | 417 | 8.46817 | 428 | 11.53183 | 9.99981 | 19 |
| 42 | 8.47226 | 424 | 8.47245 | 424 | 11.52755 | 9.99981 | 18 |
| 43 | 8.47650 | 419 | 8.47669 | 420 | 11.52331 | 9.99981 | 17 |
| 44 | 8.48069 | 416 | 8.48089 | 416 | 11.51911 | 9.99980 | 16 |
| 45 | 8.48485 | 411 | 8.48505 | 412 | 11.51495 | 9.99980 | 15 |
| 46 | 8.48896 | 408 | 8.48917 | 408 | 11.51083 | 9.99979 | 14 |
| 47 | 8.49304 | 404 | 8.49325 | 404 | 11.50675 | 9.99979 | 13 |
| 48 | 8.49708 | 400 | 8.49729 | 401 | 11.50271 | 9.99979 | 12 |
| 49 | 8.50108 | 396 | 8.50130 | 397 | 11.49870 | 9.99978 | 11 |
| 50 | 8.50504 | 393 | 8.50527 | 393 | 11.49473 | 9.99978 | 10 |
| 51 | 8.50897 | 390 | 8.50920 | 390 | 11.49080 | 9.99977 | 9 |
| 52 | 8.51287 | 386 | 8.51310 | 386 | 11.48690 | 9.99977 | 8 |
| 53 | 8.51673 | 382 | 8.51696 | 383 | 11.48304 | 9.99977 | 7 |
| 54 | 8.52055 | 379 | 8.52079 | 380 | 11.47921 | 9.99976 | 6 |
| 55 | 8.52434 | 376 | 8.52459 | 376 | 11.47541 | 9.99976 | 5 |
| 56 | 8.52810 | 373 | 8.52835 | 373 | 11.47165 | 9.99975 | 4 |
| 57 | 8.53183 | 369 | 8.53208 | 370 | 11.46792 | 9.99975 | 3 |
| 58 | 8.53552 | 367 | 8.53578 | 367 | 11.46422 | 9.99974 | 2 |
| 59 | 8.53919 | 363 | 8.53945 | 363 | 11.46055 | 9.99974 | 1 |
| 60 | 8.54282 | 360 | 8.54308 | 360 | 11.45692 | 9.99974 | 0 |
| ' | Cosine. | Cotang. | Tangent. | Sine. | ' | | |

[88 degrees.]

[2 degrees.]

| ' | Sine. | Diff. | Tangent. | Diff. | Cotang. | Diff. | Cotang. | Cosine. | ' |
|----|---------|-------|----------|-------|----------|-------|---------|---------|---|
| 30 | 8.61968 | 288 | 8.64009 | 289 | 11.35991 | 289 | 9.99959 | 30 | |
| 31 | 8.64256 | 287 | 8.64258 | 287 | 11.35702 | 287 | 9.99958 | 29 | |
| 32 | 8.64543 | 284 | 8.64585 | 285 | 11.35415 | 285 | 9.99958 | 28 | |
| 33 | 8.64827 | 283 | 8.64870 | 284 | 11.35130 | 284 | 9.99957 | 27 | |
| 34 | 8.65110 | 281 | 8.65154 | 281 | 11.34846 | 281 | 9.99956 | 26 | |
| 35 | 8.65391 | 279 | 8.65435 | 280 | 11.34565 | 280 | 9.99956 | 25 | |
| 36 | 8.65670 | 277 | 8.65715 | 278 | 11.34285 | 278 | 9.99955 | 24 | |
| 37 | 8.65947 | 276 | 8.65993 | 276 | 11.34007 | 276 | 9.99955 | 23 | |
| 38 | 8.66223 | 274 | 8.66269 | 274 | 11.33731 | 274 | 9.99954 | 22 | |
| 39 | 8.66497 | 272 | 8.66543 | 273 | 11.33457 | 273 | 9.99954 | 21 | |
| 40 | 8.66769 | 270 | 8.66816 | 271 | 11.33184 | 271 | 9.99953 | 20 | |
| 41 | 8.67039 | 269 | 8.67087 | 269 | 11.32913 | 269 | 9.99952 | 19 | |
| 42 | 8.67308 | 267 | 8.67356 | 268 | 11.32644 | 268 | 9.99952 | 18 | |
| 43 | 8.67575 | 266 | 8.67624 | 266 | 11.32376 | 266 | 9.99951 | 17 | |
| 44 | 8.67841 | 263 | 8.67890 | 264 | 11.32110 | 264 | 9.99951 | 16 | |
| 45 | 8.68104 | 263 | 8.68154 | 263 | 11.31846 | 263 | 9.99950 | 15 | |
| 46 | 8.68367 | 260 | 8.68417 | 261 | 11.31583 | 261 | 9.99949 | 14 | |
| 47 | 8.68627 | 259 | 8.68678 | 260 | 11.31322 | 260 | 9.99949 | 13 | |
| 48 | 8.68886 | 258 | 8.68938 | 258 | 11.31062 | 258 | 9.99948 | 12 | |
| 49 | 8.69144 | 256 | 8.69196 | 257 | 11.30804 | 257 | 9.99948 | 11 | |
| 50 | 8.69400 | 254 | 8.69453 | 255 | 11.30547 | 255 | 9.99947 | 10 | |
| 51 | 8.69654 | 253 | 8.69708 | 254 | 11.30292 | 254 | 9.99946 | 9 | |
| 52 | 8.69907 | 252 | 8.69962 | 252 | 11.30038 | 252 | 9.99946 | 8 | |
| 53 | 8.70159 | 250 | 8.70214 | 251 | 11.29786 | 251 | 9.99945 | 7 | |
| 54 | 8.70409 | 249 | 8.70465 | 250 | 11.29535 | 250 | 9.99944 | 6 | |
| 55 | 8.70658 | 247 | 8.70714 | 248 | 11.29286 | 248 | 9.99944 | 5 | |
| 56 | 8.70905 | 246 | 8.70962 | 246 | 11.29038 | 246 | 9.99943 | 4 | |
| 57 | 8.71151 | 244 | 8.71208 | 245 | 11.28792 | 245 | 9.99942 | 3 | |
| 58 | 8.71395 | 243 | 8.71453 | 244 | 11.28547 | 244 | 9.99942 | 2 | |
| 59 | 8.71638 | 242 | 8.71697 | 243 | 11.28303 | 243 | 9.99941 | 1 | |
| 60 | 8.71880 | 242 | 8.71940 | 243 | 11.28060 | 243 | 9.99940 | 0 | |
| | | | Cotang. | | Tangent. | | Sine. | | |

[87 degrees.]

[2 degrees.]

| ' | Sine. | Diff. | Tangent. | Diff. | Cotang. | Cosine. | ' |
|----|---------|-------|----------|-------|----------|---------|-------|
| 0 | 8.54282 | 360 | 8.54308 | 361 | 11.45692 | 9.99974 | 60 |
| 1 | 8.54642 | 357 | 8.54669 | 358 | 11.45331 | 9.99973 | 59 |
| 2 | 8.54999 | 355 | 8.55027 | 355 | 11.44973 | 9.99973 | 58 |
| 3 | 8.55354 | 351 | 8.55382 | 352 | 11.44618 | 9.99972 | 57 |
| 4 | 8.55705 | 349 | 8.55734 | 349 | 11.44266 | 9.99972 | 56 |
| 5 | 8.56054 | 346 | 8.56083 | 346 | 11.43917 | 9.99971 | 55 |
| 6 | 8.56400 | 343 | 8.56429 | 344 | 11.43571 | 9.99971 | 54 |
| 7 | 8.56743 | 341 | 8.56773 | 341 | 11.43227 | 9.99970 | 53 |
| 8 | 8.57084 | 337 | 8.57114 | 338 | 11.42886 | 9.99970 | 52 |
| 9 | 8.57421 | 336 | 8.57452 | 336 | 11.42548 | 9.99969 | 51 |
| 10 | 8.57757 | 332 | 8.57788 | 333 | 11.42212 | 9.99969 | 50 |
| 11 | 8.58089 | 330 | 8.58121 | 330 | 11.41879 | 9.99968 | 49 |
| 12 | 8.58419 | 328 | 8.58451 | 328 | 11.41549 | 9.99968 | 48 |
| 13 | 8.58747 | 325 | 8.58779 | 326 | 11.41221 | 9.99967 | 47 |
| 14 | 8.59072 | 323 | 8.59105 | 323 | 11.40895 | 9.99967 | 46 |
| 15 | 8.59395 | 320 | 8.59428 | 321 | 11.40572 | 9.99967 | 45 |
| 16 | 8.59715 | 318 | 8.59749 | 319 | 11.40251 | 9.99966 | 44 |
| 17 | 8.60033 | 316 | 8.60068 | 316 | 11.39932 | 9.99966 | 43 |
| 18 | 8.60349 | 313 | 8.60384 | 314 | 11.39616 | 9.99965 | 42 |
| 19 | 8.60662 | 311 | 8.60698 | 311 | 11.39302 | 9.99964 | 41 |
| 20 | 8.60973 | 309 | 8.61009 | 310 | 11.38991 | 9.99964 | 40 |
| 21 | 8.61282 | 307 | 8.61319 | 307 | 11.38681 | 9.99963 | 39 |
| 22 | 8.61589 | 305 | 8.61626 | 305 | 11.38374 | 9.99963 | 38 |
| 23 | 8.61894 | 302 | 8.61931 | 303 | 11.38069 | 9.99962 | 37 |
| 24 | 8.62196 | 301 | 8.62234 | 301 | 11.37766 | 9.99962 | 36 |
| 25 | 8.62497 | 298 | 8.62535 | 299 | 11.37465 | 9.99961 | 35 |
| 26 | 8.62795 | 296 | 8.62834 | 297 | 11.37166 | 9.99961 | 34 |
| 27 | 8.63091 | 294 | 8.63131 | 295 | 11.36869 | 9.99960 | 33 |
| 28 | 8.63385 | 292 | 8.63426 | 292 | 11.36574 | 9.99960 | 32 |
| 29 | 8.63678 | 290 | 8.63718 | 291 | 11.36282 | 9.99959 | 31 |
| 30 | 8.63968 | | 8.64009 | | 11.35991 | 9.99959 | 30 |
| | | | Cotang. | | Tangent. | | Sine. |

[87 degrees.]

[3 degrees.]

| ' | Sine. | Diff. | Tangent. | Diff. | Cotang. | Cosine. | ' |
|----|----------|-------|----------|----------|----------|---------|----|
| 0 | 8°7'1880 | 240 | 8°7'1940 | 241 | 11°28060 | 9°99940 | 60 |
| 1 | 8°7'2120 | 239 | 8°7'2181 | 239 | 11°27819 | 9°99940 | 59 |
| 2 | 8°7'2359 | 238 | 8°7'2420 | 239 | 11°27580 | 9°99939 | 58 |
| 3 | 8°7'2597 | 237 | 8°7'2659 | 237 | 11°27341 | 9°99938 | 57 |
| 4 | 8°7'2834 | 235 | 8°7'2896 | 236 | 11°27104 | 9°99938 | 56 |
| 5 | 8°7'3069 | 234 | 8°7'3132 | 234 | 11°26868 | 9°99937 | 55 |
| 6 | 8°7'3303 | 232 | 8°7'3366 | 234 | 11°26634 | 9°99936 | 54 |
| 7 | 8°7'3535 | 232 | 8°7'3600 | 232 | 11°26400 | 9°99936 | 53 |
| 8 | 8°7'3767 | 230 | 8°7'3832 | 231 | 11°26168 | 9°99935 | 52 |
| 9 | 8°7'3997 | 229 | 8°7'4063 | 229 | 11°25937 | 9°99934 | 51 |
| 10 | 8°7'4226 | 228 | 8°7'4292 | 229 | 11°25708 | 9°99934 | 50 |
| 11 | 8°7'4454 | 226 | 8°7'4521 | 227 | 11°25479 | 9°99933 | 49 |
| 12 | 8°7'4680 | 226 | 8°7'4748 | 226 | 11°25252 | 9°99932 | 48 |
| 13 | 8°7'4906 | 224 | 8°7'4974 | 225 | 11°25026 | 9°99932 | 47 |
| 14 | 8°7'5130 | 223 | 8°7'5199 | 224 | 11°24801 | 9°99931 | 46 |
| 15 | 8°7'5353 | 222 | 8°7'5423 | 222 | 11°24577 | 9°99930 | 45 |
| 16 | 8°7'5575 | 220 | 8°7'5645 | 222 | 11°24355 | 9°99929 | 44 |
| 17 | 8°7'5795 | 220 | 8°7'5867 | 220 | 11°24133 | 9°99929 | 43 |
| 18 | 8°7'6015 | 219 | 8°7'6087 | 219 | 11°23913 | 9°99928 | 42 |
| 19 | 8°7'6234 | 217 | 8°7'6306 | 219 | 11°23694 | 9°99927 | 41 |
| 20 | 8°7'6451 | 216 | 8°7'6525 | 217 | 11°23475 | 9°99926 | 40 |
| 21 | 8°7'6667 | 216 | 8°7'6742 | 216 | 11°23258 | 9°99926 | 39 |
| 22 | 8°7'6883 | 214 | 8°7'6958 | 215 | 11°23042 | 9°99925 | 38 |
| 23 | 8°7'7097 | 213 | 8°7'7173 | 214 | 11°22827 | 9°99924 | 37 |
| 24 | 8°7'7310 | 212 | 8°7'7387 | 213 | 11°22613 | 9°99923 | 36 |
| 25 | 8°7'7522 | 211 | 8°7'7600 | 211 | 11°22400 | 9°99923 | 35 |
| 26 | 8°7'7733 | 210 | 8°7'7781 | 210 | 11°22189 | 9°99922 | 34 |
| 27 | 8°7'7943 | 209 | 8°7'7922 | 211 | 11°21978 | 9°99921 | 33 |
| 28 | 8°7'8152 | 208 | 8°7'8232 | 209 | 11°21768 | 9°99920 | 32 |
| 29 | 8°7'8360 | 208 | 8°7'8441 | 208 | 11°21559 | 9°99920 | 31 |
| 30 | 8°7'8568 | | 8°7'8649 | 208 | 11°21351 | 9°99919 | 30 |
| ' | Cosine. | | Cotang. | Tangent. | | Sine. | ' |

[86 degrees.]

[3 degrees.]

| ' | Sine. | Diff. | Tangent. | Diff. | Cotang. | Cosine. | ' |
|----|----------|-------|----------|----------|----------|---------|----|
| 30 | 8°7'8568 | 206 | 8°7'8649 | 206 | 11°21351 | 9°99919 | 30 |
| 31 | 8°7'8774 | 205 | 8°7'8855 | 206 | 11°21145 | 9°99918 | 29 |
| 32 | 8°7'8979 | 204 | 8°7'9061 | 205 | 11°20939 | 9°99917 | 28 |
| 33 | 8°7'9183 | 203 | 8°7'9266 | 204 | 11°20734 | 9°99917 | 27 |
| 34 | 8°7'9386 | 202 | 8°7'9470 | 203 | 11°20530 | 9°99916 | 26 |
| 35 | 8°7'9588 | 201 | 8°7'9673 | 202 | 11°20327 | 9°99915 | 25 |
| 36 | 8°7'9789 | 201 | 8°7'9875 | 201 | 11°20125 | 9°99914 | 24 |
| 37 | 8°7'9990 | 199 | 8°8'0076 | 201 | 11°19924 | 9°99913 | 23 |
| 38 | 8°8'0189 | 199 | 8°8'0277 | 199 | 11°19723 | 9°99913 | 22 |
| 39 | 8°8'0388 | 197 | 8°8'0476 | 198 | 11°19524 | 9°99912 | 21 |
| 40 | 8°8'0585 | 197 | 8°8'0674 | 198 | 11°19326 | 9°99911 | 20 |
| 41 | 8°8'0782 | 196 | 8°8'0872 | 196 | 11°19128 | 9°99910 | 19 |
| 42 | 8°8'0978 | 195 | 8°8'1068 | 196 | 11°18932 | 9°99909 | 18 |
| 43 | 8°8'1173 | 194 | 8°8'1264 | 195 | 11°18736 | 9°99909 | 17 |
| 44 | 8°8'1367 | 193 | 8°8'1459 | 194 | 11°18541 | 9°99908 | 16 |
| 45 | 8°8'1560 | 192 | 8°8'1653 | 193 | 11°18347 | 9°99907 | 15 |
| 46 | 8°8'1752 | 192 | 8°8'1846 | 192 | 11°18154 | 9°99906 | 14 |
| 47 | 8°8'1944 | 190 | 8°8'2038 | 192 | 11°17962 | 9°99905 | 13 |
| 48 | 8°8'2134 | 190 | 8°8'2230 | 190 | 11°17770 | 9°99904 | 12 |
| 49 | 8°8'2324 | 189 | 8°8'2420 | 190 | 11°17580 | 9°99904 | 11 |
| 50 | 8°8'2513 | 188 | 8°8'2610 | 189 | 11°17390 | 9°99903 | 10 |
| 51 | 8°8'2701 | 187 | 8°8'2799 | 188 | 11°17201 | 9°99902 | 9 |
| 52 | 8°8'2888 | 187 | 8°8'2987 | 188 | 11°17013 | 9°99901 | 8 |
| 53 | 8°8'3075 | 186 | 8°8'3175 | 186 | 11°16825 | 9°99900 | 7 |
| 54 | 8°8'3261 | 185 | 8°8'3361 | 186 | 11°16639 | 9°99899 | 6 |
| 55 | 8°8'3446 | 184 | 8°8'3547 | 185 | 11°16453 | 9°99898 | 5 |
| 56 | 8°8'3630 | 183 | 8°8'3732 | 184 | 11°16268 | 9°99898 | 4 |
| 57 | 8°8'3813 | 183 | 8°8'3916 | 184 | 11°16084 | 9°99897 | 3 |
| 58 | 8°8'3996 | 181 | 8°8'4100 | 182 | 11°15900 | 9°99896 | 2 |
| 59 | 8°8'4177 | 181 | 8°8'4282 | 182 | 11°15718 | 9°99895 | 1 |
| 60 | 8°8'4358 | | 8°8'4464 | | 11°15536 | 9°99894 | 0 |
| ' | Cosine. | | Cotang. | Tangent. | | Sine. | ' |

[86 degrees.]

[4 degrees.]

| | Sine. | Diff. | Tangent. | Diff. | Cotang. | Diff. | Cotang. | Co-line. | |
|----|----------|-------|----------|-------|----------|-------|---------|----------|--|
| 30 | 8.84364 | 161 | 8.89598 | 161 | 11.10402 | 161 | 9.99866 | 30 | |
| 31 | 8.89625 | 159 | 8.89760 | 160 | 11.10240 | 160 | 9.99865 | 29 | |
| 32 | 8.89784 | 159 | 8.89920 | 160 | 11.10080 | 160 | 9.99864 | 28 | |
| 33 | 8.89943 | 159 | 8.90080 | 160 | 11.09920 | 160 | 9.99863 | 27 | |
| 34 | 8.90102 | 158 | 8.90240 | 159 | 11.09760 | 159 | 9.99862 | 26 | |
| 35 | 8.90260 | 157 | 8.90399 | 158 | 11.09601 | 158 | 9.99861 | 25 | |
| 36 | 8.90417 | 157 | 8.90557 | 158 | 11.09443 | 158 | 9.99860 | 24 | |
| 37 | 8.90574 | 156 | 8.90715 | 157 | 11.09285 | 157 | 9.99859 | 23 | |
| 38 | 8.90730 | 155 | 8.90872 | 157 | 11.09128 | 157 | 9.99858 | 22 | |
| 39 | 8.90885 | 155 | 8.91029 | 156 | 11.08971 | 156 | 9.99857 | 21 | |
| 40 | 8.91040 | 155 | 8.91185 | 155 | 11.08815 | 155 | 9.99856 | 20 | |
| 41 | 8.91195 | 154 | 8.91340 | 155 | 11.08660 | 155 | 9.99855 | 19 | |
| 42 | 8.91349 | 153 | 8.91495 | 155 | 11.08505 | 155 | 9.99854 | 18 | |
| 43 | 8.91502 | 153 | 8.91650 | 153 | 11.08350 | 153 | 9.99853 | 17 | |
| 44 | 8.91655 | 152 | 8.91803 | 154 | 11.08197 | 154 | 9.99852 | 16 | |
| 45 | 8.91807 | 152 | 8.91957 | 153 | 11.08043 | 153 | 9.99851 | 15 | |
| 46 | 8.91959 | 151 | 8.92110 | 152 | 11.07890 | 152 | 9.99850 | 14 | |
| 47 | 8.92110 | 151 | 8.92262 | 151 | 11.07738 | 151 | 9.99848 | 13 | |
| 48 | 8.92261 | 150 | 8.92414 | 151 | 11.07586 | 151 | 9.99847 | 12 | |
| 49 | 8.92411 | 150 | 8.92565 | 151 | 11.07435 | 151 | 9.99846 | 11 | |
| 50 | 8.92561 | 149 | 8.92716 | 149 | 11.07284 | 150 | 9.99845 | 10 | |
| 51 | 8.92710 | 148 | 8.92866 | 150 | 11.07134 | 150 | 9.99844 | 9 | |
| 52 | 8.92859 | 148 | 8.93016 | 149 | 11.06984 | 149 | 9.99843 | 8 | |
| 53 | 8.93007 | 147 | 8.93165 | 148 | 11.06835 | 148 | 9.99842 | 7 | |
| 54 | 8.93154 | 147 | 8.93313 | 147 | 11.06687 | 147 | 9.99841 | 6 | |
| 55 | 8.93301 | 147 | 8.93462 | 147 | 11.06538 | 147 | 9.99840 | 5 | |
| 56 | 8.93448 | 146 | 8.93609 | 147 | 11.06391 | 147 | 9.99839 | 4 | |
| 57 | 8.93594 | 146 | 8.93756 | 147 | 11.06244 | 147 | 9.99838 | 3 | |
| 58 | 8.93740 | 145 | 8.93903 | 146 | 11.06097 | 146 | 9.99837 | 2 | |
| 59 | 8.93885 | 145 | 8.94049 | 146 | 11.05951 | 146 | 9.99836 | 1 | |
| 60 | 8.94030 | | 8.94195 | | 11.05805 | | 9.99834 | 0 | |
| | Co-line. | | Cotang. | | Tangent. | | Sine. | | |

[85 degrees.]

[4 degrees.]

| | Sine. | Diff. | Tangent. | Diff. | Cotang. | Co-line. | |
|----|----------|-------|----------|-------|----------|----------|----|
| 0 | 8.84358 | 181 | 8.84464 | 182 | 11.15536 | 9.99894 | 60 |
| 1 | 8.84539 | 179 | 8.84646 | 180 | 11.15354 | 9.99893 | 59 |
| 2 | 8.84718 | 179 | 8.84826 | 180 | 11.15174 | 9.99892 | 58 |
| 3 | 8.84897 | 178 | 8.85006 | 179 | 11.14994 | 9.99891 | 57 |
| 4 | 8.85075 | 177 | 8.85185 | 178 | 11.14815 | 9.99891 | 56 |
| 5 | 8.85253 | 177 | 8.85363 | 177 | 11.14637 | 9.99890 | 55 |
| 6 | 8.85429 | 176 | 8.85540 | 177 | 11.14460 | 9.99889 | 54 |
| 7 | 8.85605 | 175 | 8.85717 | 176 | 11.14283 | 9.99888 | 53 |
| 8 | 8.85780 | 175 | 8.85893 | 176 | 11.14107 | 9.99887 | 52 |
| 9 | 8.85955 | 173 | 8.86069 | 174 | 11.13931 | 9.99886 | 51 |
| 10 | 8.86128 | 173 | 8.86243 | 174 | 11.13757 | 9.99885 | 50 |
| 11 | 8.86301 | 173 | 8.86417 | 174 | 11.13583 | 9.99884 | 49 |
| 12 | 8.86474 | 171 | 8.86591 | 172 | 11.13409 | 9.99883 | 48 |
| 13 | 8.86645 | 171 | 8.86763 | 172 | 11.13237 | 9.99882 | 47 |
| 14 | 8.86816 | 171 | 8.86935 | 171 | 11.13065 | 9.99881 | 46 |
| 15 | 8.86987 | 169 | 8.87106 | 171 | 11.12894 | 9.99880 | 45 |
| 16 | 8.87156 | 169 | 8.87277 | 170 | 11.12723 | 9.99879 | 44 |
| 17 | 8.87325 | 169 | 8.87447 | 169 | 11.12553 | 9.99879 | 43 |
| 18 | 8.87494 | 167 | 8.87616 | 169 | 11.12384 | 9.99878 | 42 |
| 19 | 8.87661 | 168 | 8.87785 | 168 | 11.12215 | 9.99877 | 41 |
| 20 | 8.87829 | 166 | 8.87953 | 167 | 11.12047 | 9.99876 | 40 |
| 21 | 8.87995 | 166 | 8.88120 | 167 | 11.11880 | 9.99875 | 39 |
| 22 | 8.88161 | 165 | 8.88287 | 166 | 11.11713 | 9.99874 | 38 |
| 23 | 8.88326 | 164 | 8.88453 | 165 | 11.11547 | 9.99873 | 37 |
| 24 | 8.88490 | 164 | 8.88618 | 165 | 11.11382 | 9.99872 | 36 |
| 25 | 8.88654 | 163 | 8.88783 | 165 | 11.11217 | 9.99871 | 35 |
| 26 | 8.88817 | 163 | 8.88948 | 163 | 11.11052 | 9.99870 | 34 |
| 27 | 8.88980 | 162 | 8.89111 | 163 | 11.10887 | 9.99869 | 33 |
| 28 | 8.89142 | 162 | 8.89274 | 163 | 11.10722 | 9.99868 | 32 |
| 29 | 8.89304 | 160 | 8.89437 | 161 | 11.10557 | 9.99867 | 31 |
| 30 | 8.89464 | | 8.89598 | | 11.10402 | 9.99866 | 30 |
| | Co-line. | | Cotang. | | Tangent. | Sine. | |

[85 degrees.]

[5 degrees.]

| ' | Sine. | Diff. | Tangent. | Diff. | Cotang. | Cosine. | ' |
|----|---------|-------|----------|-------|----------|---------|----|
| 0 | 8.94030 | 144 | 8.94195 | 145 | 11.05805 | 9.99834 | 60 |
| 1 | 8.94174 | 143 | 8.94340 | 145 | 11.05660 | 9.99833 | 59 |
| 2 | 8.94317 | 144 | 8.94485 | 145 | 11.05515 | 9.99832 | 58 |
| 3 | 8.94461 | 144 | 8.94630 | 143 | 11.05370 | 9.99831 | 57 |
| 4 | 8.94603 | 143 | 8.94773 | 144 | 11.05227 | 9.99829 | 56 |
| 5 | 8.94746 | 141 | 8.94917 | 143 | 11.05083 | 9.99829 | 55 |
| 6 | 8.94887 | 142 | 8.95060 | 142 | 11.04940 | 9.99828 | 54 |
| 7 | 8.95029 | 141 | 8.95202 | 142 | 11.04798 | 9.99827 | 53 |
| 8 | 8.95170 | 140 | 8.95344 | 142 | 11.04656 | 9.99825 | 52 |
| 9 | 8.95310 | 140 | 8.95486 | 141 | 11.04514 | 9.99824 | 51 |
| 10 | 8.95450 | 139 | 8.95627 | 140 | 11.04373 | 9.99823 | 50 |
| 11 | 8.95589 | 139 | 8.95767 | 141 | 11.04233 | 9.99822 | 49 |
| 12 | 8.95728 | 139 | 8.95908 | 141 | 11.04092 | 9.99821 | 48 |
| 13 | 8.95867 | 138 | 8.96047 | 140 | 11.03953 | 9.99820 | 47 |
| 14 | 8.96005 | 138 | 8.96187 | 138 | 11.03813 | 9.99819 | 46 |
| 15 | 8.96143 | 137 | 8.96325 | 139 | 11.03675 | 9.99817 | 45 |
| 16 | 8.96280 | 137 | 8.96464 | 138 | 11.03530 | 9.99816 | 44 |
| 17 | 8.96417 | 136 | 8.96602 | 137 | 11.03398 | 9.99815 | 43 |
| 18 | 8.96553 | 136 | 8.96739 | 138 | 11.03261 | 9.99814 | 42 |
| 19 | 8.96689 | 136 | 8.96877 | 136 | 11.03123 | 9.99813 | 41 |
| 20 | 8.96825 | 135 | 8.97013 | 137 | 11.02987 | 9.99812 | 40 |
| 21 | 8.96960 | 135 | 8.97150 | 137 | 11.02850 | 9.99810 | 39 |
| 22 | 8.97095 | 134 | 8.97285 | 136 | 11.02715 | 9.99809 | 38 |
| 23 | 8.97229 | 134 | 8.97421 | 135 | 11.02579 | 9.99808 | 37 |
| 24 | 8.97363 | 133 | 8.97556 | 135 | 11.02444 | 9.99807 | 36 |
| 25 | 8.97496 | 133 | 8.97691 | 134 | 11.02309 | 9.99806 | 35 |
| 26 | 8.97629 | 133 | 8.97825 | 134 | 11.02175 | 9.99804 | 34 |
| 27 | 8.97762 | 132 | 8.97959 | 133 | 11.02041 | 9.99803 | 33 |
| 28 | 8.97894 | 132 | 8.98092 | 133 | 11.01908 | 9.99802 | 32 |
| 29 | 8.98026 | 131 | 8.98225 | 133 | 11.01775 | 9.99801 | 31 |
| 30 | 8.98157 | | 8.98358 | 133 | 11.01642 | 9.99800 | 30 |
| ' | Cosine. | | Cotang. | | Tangent. | Sine. | ' |

[84 degrees.]

[5 degrees.]

| ' | Sine. | Diff. | Tangent. | Diff. | Cotang. | Cosine. | ' |
|----|---------|-------|----------|-------|----------|---------|----|
| 30 | 8.98157 | 131 | 8.98358 | 132 | 11.01642 | 9.99800 | 30 |
| 31 | 8.98288 | 131 | 8.98490 | 132 | 11.01510 | 9.99798 | 29 |
| 32 | 8.98419 | 130 | 8.98622 | 131 | 11.01378 | 9.99797 | 28 |
| 33 | 8.98549 | 130 | 8.98753 | 131 | 11.01247 | 9.99796 | 27 |
| 34 | 8.98679 | 129 | 8.98884 | 131 | 11.01116 | 9.99795 | 26 |
| 35 | 8.98808 | 129 | 8.99015 | 130 | 11.00985 | 9.99793 | 25 |
| 36 | 8.98937 | 129 | 8.99145 | 130 | 11.00855 | 9.99792 | 24 |
| 37 | 8.99066 | 128 | 8.99275 | 130 | 11.00725 | 9.99791 | 23 |
| 38 | 8.99194 | 128 | 8.99405 | 129 | 11.00595 | 9.99790 | 22 |
| 39 | 8.99322 | 128 | 8.99534 | 128 | 11.00466 | 9.99788 | 21 |
| 40 | 8.99450 | 127 | 8.99662 | 129 | 11.00338 | 9.99787 | 20 |
| 41 | 8.99577 | 127 | 8.99791 | 127 | 11.00209 | 9.99786 | 19 |
| 42 | 8.99704 | 126 | 8.99919 | 127 | 11.00081 | 9.99785 | 18 |
| 43 | 8.99836 | 126 | 9.00047 | 126 | 10.99954 | 9.99783 | 17 |
| 44 | 8.99956 | 126 | 9.00174 | 127 | 10.99826 | 9.99782 | 16 |
| 45 | 9.00082 | 125 | 9.00301 | 126 | 10.99699 | 9.99781 | 15 |
| 46 | 9.00207 | 125 | 9.00427 | 126 | 10.99573 | 9.99780 | 14 |
| 47 | 9.00332 | 124 | 9.00553 | 126 | 10.99447 | 9.99778 | 13 |
| 48 | 9.00456 | 125 | 9.00679 | 126 | 10.99321 | 9.99777 | 12 |
| 49 | 9.00581 | 123 | 9.00805 | 125 | 10.99195 | 9.99776 | 11 |
| 50 | 9.00704 | 124 | 9.00930 | 125 | 10.99070 | 9.99775 | 10 |
| 51 | 9.00828 | 123 | 9.01055 | 124 | 10.98945 | 9.99773 | 9 |
| 52 | 9.00951 | 123 | 9.01179 | 124 | 10.98821 | 9.99772 | 8 |
| 53 | 9.01074 | 122 | 9.01303 | 124 | 10.98697 | 9.99771 | 7 |
| 54 | 9.01196 | 122 | 9.01427 | 123 | 10.98573 | 9.99769 | 6 |
| 55 | 9.01318 | 122 | 9.01550 | 123 | 10.98450 | 9.99768 | 5 |
| 56 | 9.01440 | 121 | 9.01673 | 123 | 10.98327 | 9.99767 | 4 |
| 57 | 9.01561 | 121 | 9.01796 | 122 | 10.98204 | 9.99765 | 3 |
| 58 | 9.01682 | 121 | 9.01918 | 122 | 10.98082 | 9.99764 | 2 |
| 59 | 9.01803 | 120 | 9.02040 | 122 | 10.97960 | 9.99763 | 1 |
| 60 | 9.01923 | | 9.02162 | | 10.97838 | 9.99761 | 0 |
| ' | Cosine. | | Cotang. | | Tangent. | Sine. | ' |

[84 degrees.]

[6 degrees.]

| | Sine. | Tangent. | Diff. | Cotang. | Cosine. | |
|----|---------|----------|-------|----------|---------|----|
| 30 | 9°05386 | 9°05666 | 111 | 10°94324 | 9°99720 | 30 |
| 31 | 9°05497 | 9°05778 | 110 | 10°94224 | 9°99718 | 29 |
| 32 | 9°05607 | 9°05890 | 110 | 10°94110 | 9°99717 | 28 |
| 33 | 9°05717 | 9°06002 | 110 | 10°93998 | 9°99716 | 27 |
| 34 | 9°05827 | 9°06113 | 110 | 10°93887 | 9°99714 | 26 |
| 35 | 9°05937 | 9°06224 | 109 | 10°93776 | 9°99713 | 25 |
| 36 | 9°06046 | 9°06335 | 109 | 10°93665 | 9°99711 | 24 |
| 37 | 9°06155 | 9°06445 | 109 | 10°93555 | 9°99710 | 23 |
| 38 | 9°06264 | 9°06556 | 108 | 10°93444 | 9°99708 | 22 |
| 39 | 9°06372 | 9°06666 | 109 | 10°93334 | 9°99707 | 21 |
| 40 | 9°06481 | 9°06775 | 108 | 10°93225 | 9°99705 | 20 |
| 41 | 9°06589 | 9°06885 | 107 | 10°93115 | 9°99704 | 19 |
| 42 | 9°06696 | 9°06994 | 108 | 10°93006 | 9°99702 | 18 |
| 43 | 9°06804 | 9°07103 | 107 | 10°92897 | 9°99701 | 17 |
| 44 | 9°06911 | 9°07211 | 107 | 10°92789 | 9°99699 | 16 |
| 45 | 9°07018 | 9°07320 | 106 | 10°92680 | 9°99698 | 15 |
| 46 | 9°07124 | 9°07428 | 107 | 10°92572 | 9°99696 | 14 |
| 47 | 9°07231 | 9°07536 | 106 | 10°92464 | 9°99695 | 13 |
| 48 | 9°07337 | 9°07643 | 105 | 10°92357 | 9°99693 | 12 |
| 49 | 9°07442 | 9°07751 | 106 | 10°92249 | 9°99692 | 11 |
| 50 | 9°07548 | 9°07858 | 105 | 10°92142 | 9°99690 | 10 |
| 51 | 9°07653 | 9°07964 | 105 | 10°92036 | 9°99689 | 9 |
| 52 | 9°07758 | 9°08071 | 105 | 10°91929 | 9°99687 | 8 |
| 53 | 9°07863 | 9°08177 | 105 | 10°91823 | 9°99686 | 7 |
| 54 | 9°07968 | 9°08283 | 104 | 10°91717 | 9°99684 | 6 |
| 55 | 9°08072 | 9°08389 | 104 | 10°91611 | 9°99683 | 5 |
| 56 | 9°08176 | 9°08495 | 104 | 10°91505 | 9°99681 | 4 |
| 57 | 9°08280 | 9°08600 | 103 | 10°91400 | 9°99680 | 3 |
| 58 | 9°08383 | 9°08705 | 103 | 10°91295 | 9°99678 | 2 |
| 59 | 9°08486 | 9°08810 | 103 | 10°91190 | 9°99677 | 1 |
| 60 | 9°08589 | 9°08914 | 103 | 10°91086 | 9°99675 | 0 |
| | Cosine. | Cotang. | | Tangent. | Sine. | |

[83 degrees.]

[6 degrees.]

| | Sine. | Tangent. | Diff. | Cotang. | Cosine. | |
|----|---------|----------|-------|----------|---------|----|
| 0 | 9°01923 | 9°02162 | 121 | 10°97838 | 9°99761 | 60 |
| 1 | 9°02043 | 9°02283 | 121 | 10°97717 | 9°99760 | 59 |
| 2 | 9°02163 | 9°02404 | 121 | 10°97596 | 9°99759 | 58 |
| 3 | 9°02283 | 9°02525 | 120 | 10°97475 | 9°99757 | 57 |
| 4 | 9°02402 | 9°02645 | 120 | 10°97355 | 9°99756 | 56 |
| 5 | 9°02520 | 9°02766 | 119 | 10°97234 | 9°99755 | 55 |
| 6 | 9°02639 | 9°02885 | 120 | 10°97115 | 9°99753 | 54 |
| 7 | 9°02757 | 9°03005 | 119 | 10°96995 | 9°99752 | 53 |
| 8 | 9°02874 | 9°03124 | 118 | 10°96876 | 9°99751 | 52 |
| 9 | 9°02992 | 9°03242 | 117 | 10°96758 | 9°99749 | 51 |
| 10 | 9°03109 | 9°03361 | 118 | 10°96639 | 9°99748 | 50 |
| 11 | 9°03226 | 9°03479 | 118 | 10°96521 | 9°99747 | 49 |
| 12 | 9°03344 | 9°03597 | 117 | 10°96403 | 9°99745 | 48 |
| 13 | 9°03462 | 9°03714 | 117 | 10°96286 | 9°99744 | 47 |
| 14 | 9°03579 | 9°03832 | 116 | 10°96168 | 9°99742 | 46 |
| 15 | 9°03690 | 9°03948 | 117 | 10°96052 | 9°99741 | 45 |
| 16 | 9°03805 | 9°04065 | 116 | 10°95935 | 9°99740 | 44 |
| 17 | 9°03920 | 9°04181 | 116 | 10°95819 | 9°99738 | 43 |
| 18 | 9°04034 | 9°04297 | 115 | 10°95703 | 9°99737 | 42 |
| 19 | 9°04149 | 9°04413 | 115 | 10°95587 | 9°99736 | 41 |
| 20 | 9°04262 | 9°04528 | 115 | 10°95472 | 9°99734 | 40 |
| 21 | 9°04376 | 9°04643 | 114 | 10°95357 | 9°99733 | 39 |
| 22 | 9°04490 | 9°04758 | 114 | 10°95242 | 9°99731 | 38 |
| 23 | 9°04603 | 9°04873 | 114 | 10°95127 | 9°99730 | 37 |
| 24 | 9°04715 | 9°04987 | 113 | 10°95013 | 9°99728 | 36 |
| 25 | 9°04828 | 9°05101 | 113 | 10°94899 | 9°99727 | 35 |
| 26 | 9°04940 | 9°05214 | 114 | 10°94786 | 9°99726 | 34 |
| 27 | 9°05052 | 9°05328 | 112 | 10°94672 | 9°99724 | 33 |
| 28 | 9°05164 | 9°05441 | 111 | 10°94559 | 9°99723 | 32 |
| 29 | 9°05275 | 9°05553 | 111 | 10°94447 | 9°99721 | 31 |
| 30 | 9°05386 | 9°05666 | 113 | 10°94334 | 9°99720 | 30 |
| | Cosine. | Cotang. | | Tangent. | Sine. | |

[83 degrees.]

[7 degrees.]

| ' | Sine. | Diff. | Tangent. | Diff. | Cotang. | Diff. | Cosine. | ' |
|----|---------|-------|----------|-------|----------|-------|---------|----|
| 30 | 9°11570 | 96 | 9°11943 | 96 | 10°88057 | 97 | 9°99627 | 30 |
| 31 | 9°11666 | 95 | 9°12040 | 95 | 10°87960 | 98 | 9°99625 | 29 |
| 32 | 9°11761 | 96 | 9°12138 | 96 | 10°87862 | 97 | 9°99624 | 28 |
| 33 | 9°11857 | 95 | 9°12235 | 95 | 10°87765 | 97 | 9°99622 | 27 |
| 34 | 9°11952 | 95 | 9°12332 | 95 | 10°87668 | 96 | 9°99620 | 26 |
| 35 | 9°12047 | 95 | 9°12428 | 95 | 10°87572 | 96 | 9°99618 | 25 |
| 36 | 9°12142 | 94 | 9°12525 | 94 | 10°87475 | 97 | 9°99617 | 24 |
| 37 | 9°12236 | 95 | 9°12621 | 95 | 10°87379 | 96 | 9°99615 | 23 |
| 38 | 9°12331 | 94 | 9°12717 | 94 | 10°87283 | 96 | 9°99613 | 22 |
| 39 | 9°12425 | 94 | 9°12813 | 94 | 10°87187 | 96 | 9°99612 | 21 |
| 40 | 9°12519 | 93 | 9°12909 | 93 | 10°87091 | 95 | 9°99610 | 20 |
| 41 | 9°12612 | 94 | 9°13004 | 94 | 10°86996 | 95 | 9°99608 | 19 |
| 42 | 9°12706 | 93 | 9°13099 | 93 | 10°86901 | 95 | 9°99607 | 18 |
| 43 | 9°12799 | 93 | 9°13194 | 93 | 10°86806 | 95 | 9°99605 | 17 |
| 44 | 9°12892 | 93 | 9°13289 | 93 | 10°86711 | 95 | 9°99603 | 16 |
| 45 | 9°12985 | 93 | 9°13384 | 93 | 10°86616 | 95 | 9°99601 | 15 |
| 46 | 9°13078 | 93 | 9°13478 | 93 | 10°86522 | 95 | 9°99600 | 14 |
| 47 | 9°13171 | 92 | 9°13573 | 92 | 10°86427 | 95 | 9°99598 | 13 |
| 48 | 9°13263 | 92 | 9°13667 | 92 | 10°86333 | 94 | 9°99596 | 12 |
| 49 | 9°13355 | 92 | 9°13761 | 92 | 10°86239 | 94 | 9°99595 | 11 |
| 50 | 9°13447 | 92 | 9°13854 | 92 | 10°86146 | 94 | 9°99593 | 10 |
| 51 | 9°13539 | 91 | 9°13948 | 91 | 10°86052 | 94 | 9°99591 | 9 |
| 52 | 9°13630 | 92 | 9°14041 | 92 | 10°85959 | 93 | 9°99589 | 8 |
| 53 | 9°13722 | 91 | 9°14134 | 91 | 10°85866 | 93 | 9°99588 | 7 |
| 54 | 9°13813 | 91 | 9°14227 | 91 | 10°85773 | 93 | 9°99586 | 6 |
| 55 | 9°13904 | 90 | 9°14320 | 90 | 10°85680 | 92 | 9°99584 | 5 |
| 56 | 9°13994 | 90 | 9°14412 | 90 | 10°85588 | 92 | 9°99582 | 4 |
| 57 | 9°14085 | 91 | 9°14504 | 91 | 10°85496 | 92 | 9°99581 | 3 |
| 58 | 9°14175 | 91 | 9°14597 | 91 | 10°85403 | 91 | 9°99579 | 2 |
| 59 | 9°14266 | 90 | 9°14688 | 90 | 10°85312 | 92 | 9°99577 | 1 |
| 60 | 9°14356 | | 9°14780 | | 10°85220 | | 9°99575 | 0 |
| ' | Cosine. | | Cotang. | | Tangent. | | Sine. | ' |

[82 degrees.]

[7 degrees.]

| ' | Sine. | Diff. | Tangents. | Diff. | Cotang. | Cosine. | ' | |
|----|---------|-------|-----------|-------|----------|---------|-------|---|
| 0 | 9°08889 | 103 | 9°08914 | 105 | 10°91086 | 9°99675 | 60 | |
| 1 | 9°08892 | 103 | 9°09019 | 104 | 10°90981 | 9°99674 | 59 | |
| 2 | 9°08795 | 102 | 9°09123 | 104 | 10°90877 | 9°99672 | 58 | |
| 3 | 9°08897 | 102 | 9°09227 | 103 | 10°90773 | 9°99670 | 57 | |
| 4 | 9°08999 | 102 | 9°09330 | 104 | 10°90670 | 9°99669 | 56 | |
| 5 | 9°09101 | 101 | 9°09434 | 103 | 10°90566 | 9°99667 | 55 | |
| 6 | 9°09202 | 102 | 9°09537 | 103 | 10°90463 | 9°99666 | 54 | |
| 7 | 9°09304 | 101 | 9°09640 | 102 | 10°90360 | 9°99664 | 53 | |
| 8 | 9°09405 | 101 | 9°09742 | 103 | 10°90258 | 9°99663 | 52 | |
| 9 | 9°09506 | 100 | 9°09845 | 102 | 10°90155 | 9°99661 | 51 | |
| 10 | 9°09606 | 101 | 9°09947 | 102 | 10°90053 | 9°99659 | 50 | |
| 11 | 9°09707 | 100 | 9°10049 | 101 | 10°89951 | 9°99658 | 49 | |
| 12 | 9°09807 | 100 | 9°10150 | 102 | 10°89849 | 9°99656 | 48 | |
| 13 | 9°09907 | 99 | 9°10252 | 101 | 10°89748 | 9°99655 | 47 | |
| 14 | 9°10006 | 100 | 9°10353 | 101 | 10°89647 | 9°99653 | 46 | |
| 15 | 9°10106 | 99 | 9°10454 | 101 | 10°89546 | 9°99651 | 45 | |
| 16 | 9°10205 | 99 | 9°10555 | 101 | 10°89445 | 9°99650 | 44 | |
| 17 | 9°10304 | 98 | 9°10656 | 100 | 10°89344 | 9°99648 | 43 | |
| 18 | 9°10402 | 99 | 9°10756 | 100 | 10°89244 | 9°99647 | 42 | |
| 19 | 9°10501 | 98 | 9°10856 | 100 | 10°89144 | 9°99645 | 41 | |
| 20 | 9°10599 | 98 | 9°10956 | 100 | 10°89044 | 9°99643 | 40 | |
| 21 | 9°10697 | 98 | 9°11056 | 99 | 10°88944 | 9°99642 | 39 | |
| 22 | 9°10795 | 98 | 9°11155 | 99 | 10°88845 | 9°99640 | 38 | |
| 23 | 9°10893 | 97 | 9°11254 | 99 | 10°88746 | 9°99638 | 37 | |
| 24 | 9°10990 | 97 | 9°11353 | 99 | 10°88647 | 9°99637 | 36 | |
| 25 | 9°11087 | 97 | 9°11452 | 99 | 10°88548 | 9°99635 | 35 | |
| 26 | 9°11184 | 97 | 9°11551 | 98 | 10°88449 | 9°99633 | 34 | |
| 27 | 9°11281 | 96 | 9°11649 | 98 | 10°88351 | 9°99632 | 33 | |
| 28 | 9°11377 | 97 | 9°11747 | 98 | 10°88253 | 9°99630 | 32 | |
| 29 | 9°11474 | 96 | 9°11845 | 98 | 10°88155 | 9°99629 | 31 | |
| 30 | 9°11570 | | 9°11943 | | 10°88057 | 9°99627 | 30 | |
| ' | Cosine. | | Cotang. | | Tangent. | | Sine. | ' |

[82 degrees.]

[8 degrees.]

| ' | Sine. | Diff. | Tangent. | Diff. | Cotang. | Diff. | Cotang. | Cosine. | D. |
|----|---------|-------|----------|-------|----------|--------|---------|---------|----|
| 30 | 9°14356 | 89 | 9°14780 | 91 | 10°85220 | 999575 | 9°14780 | 9°14356 | 30 |
| 1 | 9°14445 | 90 | 9°14872 | 91 | 10°85128 | 999574 | 9°14872 | 9°14445 | 29 |
| 2 | 9°14535 | 89 | 9°14963 | 91 | 10°85037 | 999572 | 9°14963 | 9°14535 | 28 |
| 3 | 9°14624 | 90 | 9°15054 | 91 | 10°84946 | 999570 | 9°15054 | 9°14624 | 27 |
| 4 | 9°14714 | 89 | 9°15145 | 91 | 10°84855 | 999568 | 9°15145 | 9°14714 | 26 |
| 5 | 9°14803 | 88 | 9°15236 | 91 | 10°84764 | 999566 | 9°15236 | 9°14803 | 25 |
| 6 | 9°14891 | 89 | 9°15327 | 90 | 10°84673 | 999565 | 9°15327 | 9°14891 | 24 |
| 7 | 9°14980 | 89 | 9°15417 | 91 | 10°84583 | 999563 | 9°15417 | 9°14980 | 23 |
| 8 | 9°15069 | 88 | 9°15508 | 90 | 10°84492 | 999561 | 9°15508 | 9°15069 | 22 |
| 9 | 9°15157 | 88 | 9°15598 | 90 | 10°84402 | 999559 | 9°15598 | 9°15157 | 21 |
| 10 | 9°15245 | 88 | 9°15688 | 89 | 10°84312 | 999557 | 9°15688 | 9°15245 | 20 |
| 11 | 9°15333 | 88 | 9°15777 | 90 | 10°84223 | 999556 | 9°15777 | 9°15333 | 19 |
| 12 | 9°15421 | 87 | 9°15867 | 89 | 10°84133 | 999554 | 9°15867 | 9°15421 | 18 |
| 13 | 9°15508 | 88 | 9°15956 | 90 | 10°84044 | 999552 | 9°15956 | 9°15508 | 17 |
| 14 | 9°15596 | 87 | 9°16046 | 89 | 10°83954 | 999550 | 9°16046 | 9°15596 | 16 |
| 15 | 9°15683 | 87 | 9°16135 | 89 | 10°83865 | 999548 | 9°16135 | 9°15683 | 15 |
| 16 | 9°15770 | 87 | 9°16224 | 88 | 10°83776 | 999546 | 9°16224 | 9°15770 | 14 |
| 17 | 9°15857 | 87 | 9°16312 | 89 | 10°83688 | 999545 | 9°16312 | 9°15857 | 13 |
| 18 | 9°15944 | 86 | 9°16401 | 88 | 10°83599 | 999543 | 9°16401 | 9°15944 | 12 |
| 19 | 9°16030 | 86 | 9°16489 | 88 | 10°83511 | 999541 | 9°16489 | 9°16030 | 11 |
| 20 | 9°16116 | 87 | 9°16577 | 88 | 10°83423 | 999539 | 9°16577 | 9°16116 | 10 |
| 21 | 9°16203 | 86 | 9°16665 | 88 | 10°83335 | 999537 | 9°16665 | 9°16203 | 9 |
| 22 | 9°16289 | 85 | 9°16753 | 88 | 10°83247 | 999535 | 9°16753 | 9°16289 | 8 |
| 23 | 9°16374 | 86 | 9°16841 | 87 | 10°83159 | 999533 | 9°16841 | 9°16374 | 7 |
| 24 | 9°16460 | 85 | 9°16928 | 88 | 10°83072 | 999532 | 9°16928 | 9°16460 | 6 |
| 25 | 9°16545 | 86 | 9°17016 | 87 | 10°82984 | 999530 | 9°17016 | 9°16545 | 5 |
| 26 | 9°16631 | 85 | 9°17103 | 87 | 10°82897 | 999528 | 9°17103 | 9°16631 | 4 |
| 27 | 9°16716 | 85 | 9°17190 | 87 | 10°82810 | 999526 | 9°17190 | 9°16716 | 3 |
| 28 | 9°16801 | 85 | 9°17277 | 86 | 10°82723 | 999524 | 9°17277 | 9°16801 | 2 |
| 29 | 9°16886 | 84 | 9°17363 | 87 | 10°82637 | 999522 | 9°17363 | 9°16886 | 1 |
| 30 | 9°16970 | | 9°17450 | | 10°82550 | 999520 | 9°17450 | 9°16970 | 0 |

[81 degrees.]

| ' | Sine. | Diff. | Tangent. | Diff. | Cotang. | Cosine. | D. |
|----|---------|-------|----------|-------|----------|---------|----|
| 0 | 9°14356 | 89 | 9°14780 | 91 | 10°85220 | 999575 | 60 |
| 1 | 9°14445 | 90 | 9°14872 | 91 | 10°85128 | 999574 | 59 |
| 2 | 9°14535 | 89 | 9°14963 | 91 | 10°85037 | 999572 | 58 |
| 3 | 9°14624 | 90 | 9°15054 | 91 | 10°84946 | 999570 | 57 |
| 4 | 9°14714 | 89 | 9°15145 | 91 | 10°84855 | 999568 | 56 |
| 5 | 9°14803 | 88 | 9°15236 | 91 | 10°84764 | 999566 | 55 |
| 6 | 9°14891 | 89 | 9°15327 | 90 | 10°84673 | 999565 | 54 |
| 7 | 9°14980 | 89 | 9°15417 | 91 | 10°84583 | 999563 | 53 |
| 8 | 9°15069 | 88 | 9°15508 | 90 | 10°84492 | 999561 | 52 |
| 9 | 9°15157 | 88 | 9°15598 | 90 | 10°84402 | 999559 | 51 |
| 10 | 9°15245 | 88 | 9°15688 | 89 | 10°84312 | 999557 | 50 |
| 11 | 9°15333 | 88 | 9°15777 | 90 | 10°84223 | 999556 | 49 |
| 12 | 9°15421 | 87 | 9°15867 | 89 | 10°84133 | 999554 | 48 |
| 13 | 9°15508 | 88 | 9°15956 | 90 | 10°84044 | 999552 | 47 |
| 14 | 9°15596 | 87 | 9°16046 | 89 | 10°83954 | 999550 | 46 |
| 15 | 9°15683 | 87 | 9°16135 | 89 | 10°83865 | 999548 | 45 |
| 16 | 9°15770 | 87 | 9°16224 | 88 | 10°83776 | 999546 | 44 |
| 17 | 9°15857 | 87 | 9°16312 | 89 | 10°83688 | 999545 | 43 |
| 18 | 9°15944 | 86 | 9°16401 | 88 | 10°83599 | 999543 | 42 |
| 19 | 9°16030 | 86 | 9°16489 | 88 | 10°83511 | 999541 | 41 |
| 20 | 9°16116 | 87 | 9°16577 | 88 | 10°83423 | 999539 | 40 |
| 21 | 9°16203 | 86 | 9°16665 | 88 | 10°83335 | 999537 | 39 |
| 22 | 9°16289 | 85 | 9°16753 | 88 | 10°83247 | 999535 | 38 |
| 23 | 9°16374 | 86 | 9°16841 | 87 | 10°83159 | 999533 | 37 |
| 24 | 9°16460 | 85 | 9°16928 | 88 | 10°83072 | 999532 | 36 |
| 25 | 9°16545 | 86 | 9°17016 | 87 | 10°82984 | 999530 | 35 |
| 26 | 9°16631 | 85 | 9°17103 | 87 | 10°82897 | 999528 | 34 |
| 27 | 9°16716 | 85 | 9°17190 | 87 | 10°82810 | 999526 | 33 |
| 28 | 9°16801 | 85 | 9°17277 | 86 | 10°82723 | 999524 | 32 |
| 29 | 9°16886 | 84 | 9°17363 | 87 | 10°82637 | 999522 | 31 |
| 30 | 9°16970 | | 9°17450 | | 10°82550 | 999520 | 30 |

[81 degrees.]

[9 degrees]

[illegible]

[80 degrees.]

| | Sine. | Diff. | Tangent. | Diff. | Cotang. | Cosine. | D. |
|----|---------|---------|----------|----------|-----------|----------|----|
| 0 | 9°19'43 | 80 | 9°19'71 | 82 | 10°8'0029 | 9°99'462 | 60 |
| 1 | 9°19'53 | 79 | 9°20'053 | 81 | 10°7'9947 | 9°99'460 | 59 |
| 2 | 9°19'59 | 79 | 9°20'134 | 82 | 10°7'9866 | 9°99'458 | 58 |
| 3 | 9°19'67 | 79 | 9°20'216 | 81 | 10°7'9784 | 9°99'456 | 57 |
| 4 | 9°19'75 | 79 | 9°20'297 | 81 | 10°7'9703 | 9°99'454 | 56 |
| 5 | 9°19'83 | 79 | 9°20'378 | 81 | 10°7'9622 | 9°99'452 | 55 |
| 6 | 9°19'90 | 79 | 9°20'459 | 81 | 10°7'9541 | 9°99'450 | 54 |
| 7 | 9°19'98 | 79 | 9°20'540 | 81 | 10°7'9460 | 9°99'448 | 53 |
| 8 | 9°20'06 | 78 | 9°20'621 | 80 | 10°7'9379 | 9°99'446 | 52 |
| 9 | 9°20'14 | 78 | 9°20'701 | 81 | 10°7'9299 | 9°99'444 | 51 |
| 10 | 9°20'22 | 78 | 9°20'782 | 81 | 10°7'9218 | 9°99'442 | 50 |
| 11 | 9°20'30 | 78 | 9°20'862 | 80 | 10°7'9138 | 9°99'440 | 49 |
| 12 | 9°20'38 | 78 | 9°20'944 | 80 | 10°7'9058 | 9°99'438 | 48 |
| 13 | 9°20'45 | 77 | 9°21'022 | 80 | 10°7'8978 | 9°99'436 | 47 |
| 14 | 9°20'53 | 78 | 9°21'102 | 80 | 10°7'8898 | 9°99'434 | 46 |
| 15 | 9°20'61 | 78 | 9°21'182 | 79 | 10°7'8818 | 9°99'432 | 45 |
| 16 | 9°20'69 | 77 | 9°21'261 | 80 | 10°7'8739 | 9°99'430 | 44 |
| 17 | 9°20'76 | 77 | 9°21'341 | 79 | 10°7'8659 | 9°99'428 | 43 |
| 18 | 9°20'84 | 77 | 9°21'420 | 79 | 10°7'8580 | 9°99'426 | 42 |
| 19 | 9°20'92 | 77 | 9°21'499 | 79 | 10°7'8501 | 9°99'424 | 41 |
| 20 | 9°20'99 | 77 | 9°21'578 | 79 | 10°7'8422 | 9°99'422 | 40 |
| 21 | 9°21'07 | 77 | 9°21'657 | 79 | 10°7'8343 | 9°99'419 | 39 |
| 22 | 9°21'15 | 76 | 9°21'736 | 78 | 10°7'8264 | 9°99'417 | 38 |
| 23 | 9°21'22 | 77 | 9°21'814 | 79 | 10°7'8186 | 9°99'415 | 37 |
| 24 | 9°21'30 | 76 | 9°21'893 | 78 | 10°7'8107 | 9°99'413 | 36 |
| 25 | 9°21'38 | 76 | 9°21'971 | 78 | 10°7'8029 | 9°99'411 | 35 |
| 26 | 9°21'45 | 76 | 9°22'049 | 78 | 10°7'7951 | 9°99'409 | 34 |
| 27 | 9°21'53 | 76 | 9°22'127 | 78 | 10°7'7873 | 9°99'407 | 33 |
| 28 | 9°21'61 | 75 | 9°22'205 | 78 | 10°7'7795 | 9°99'405 | 32 |
| 29 | 9°21'68 | 76 | 9°22'283 | 78 | 10°7'7717 | 9°99'402 | 31 |
| 30 | 9°21'76 | | 9°22'361 | | 10°7'7639 | 9°99'400 | 30 |
| | Sine. | Cotang. | | Tangent. | | Sine. | |

[80 degrees.]

[10 degrés.]

| ' | Sine. | Diff. | Tangent. | Diff. | Tangent. | Diff. | Cotang. | Cosine. | D. | ' |
|----|---------|-------|----------|-------|----------|-------|---------|---------|----|---|
| 30 | 9°26063 | 68 | 9°26797 | 68 | 10°73203 | 70 | 9°99267 | 3 | 30 | |
| 31 | 9°26131 | 68 | 9°26867 | 68 | 10°73133 | 70 | 9°99264 | 3 | 29 | |
| 32 | 9°26199 | 68 | 9°26937 | 68 | 10°73063 | 71 | 9°99262 | 2 | 28 | |
| 33 | 9°26267 | 68 | 9°27008 | 68 | 10°72992 | 71 | 9°99260 | 2 | 27 | |
| 34 | 9°26335 | 68 | 9°27078 | 68 | 10°72922 | 70 | 9°99257 | 2 | 26 | |
| 35 | 9°26403 | 67 | 9°27148 | 67 | 10°72852 | 70 | 9°99255 | 2 | 25 | |
| 36 | 9°26470 | 68 | 9°27218 | 68 | 10°72782 | 70 | 9°99252 | 3 | 24 | |
| 37 | 9°26538 | 67 | 9°27288 | 67 | 10°72712 | 70 | 9°99250 | 2 | 23 | |
| 38 | 9°26605 | 67 | 9°27357 | 67 | 10°72643 | 69 | 9°99248 | 2 | 22 | |
| 39 | 9°26672 | 67 | 9°27427 | 67 | 10°72573 | 69 | 9°99245 | 2 | 21 | |
| 40 | 9°26739 | 67 | 9°27496 | 67 | 10°72504 | 69 | 9°99243 | 2 | 20 | |
| 41 | 9°26806 | 67 | 9°27566 | 67 | 10°72434 | 69 | 9°99241 | 3 | 19 | |
| 42 | 9°26873 | 67 | 9°27635 | 67 | 10°72365 | 69 | 9°99238 | 3 | 18 | |
| 43 | 9°26940 | 67 | 9°27704 | 67 | 10°72296 | 69 | 9°99236 | 3 | 17 | |
| 44 | 9°27007 | 66 | 9°27773 | 66 | 10°72227 | 69 | 9°99233 | 2 | 16 | |
| 45 | 9°27073 | 67 | 9°27842 | 67 | 10°72158 | 69 | 9°99231 | 2 | 15 | |
| 46 | 9°27140 | 66 | 9°27911 | 66 | 10°72089 | 69 | 9°99229 | 3 | 14 | |
| 47 | 9°27206 | 67 | 9°27980 | 67 | 10°72020 | 69 | 9°99226 | 3 | 13 | |
| 48 | 9°27273 | 66 | 9°28049 | 66 | 10°71951 | 68 | 9°99224 | 2 | 12 | |
| 49 | 9°27339 | 66 | 9°28117 | 66 | 10°71883 | 69 | 9°99221 | 3 | 11 | |
| 50 | 9°27405 | 66 | 9°28186 | 66 | 10°71814 | 68 | 9°99219 | 2 | 10 | |
| 51 | 9°27471 | 66 | 9°28254 | 66 | 10°71746 | 69 | 9°99217 | 3 | 9 | |
| 52 | 9°27537 | 65 | 9°28323 | 65 | 10°71677 | 68 | 9°99214 | 2 | 8 | |
| 53 | 9°27602 | 66 | 9°28391 | 66 | 10°71609 | 68 | 9°99212 | 2 | 7 | |
| 54 | 9°27668 | 66 | 9°28459 | 66 | 10°71541 | 68 | 9°99209 | 2 | 6 | |
| 55 | 9°27734 | 65 | 9°28527 | 65 | 10°71473 | 68 | 9°99207 | 3 | 5 | |
| 56 | 9°27799 | 65 | 9°28595 | 65 | 10°71405 | 67 | 9°99204 | 3 | 4 | |
| 57 | 9°27864 | 66 | 9°28662 | 66 | 10°71338 | 68 | 9°99202 | 2 | 3 | |
| 58 | 9°27930 | 65 | 9°28730 | 65 | 10°71270 | 68 | 9°99200 | 2 | 2 | |
| 59 | 9°27995 | 65 | 9°28798 | 65 | 10°71202 | 67 | 9°99197 | 3 | 1 | |
| 60 | 9°28060 | 65 | 9°28865 | 65 | 10°71135 | 67 | 9°99195 | 2 | 0 | |
| ' | Cosine. | | Cotang. | | Tangent. | | Sine. | | ' | |

[79 degrees.]

[10 degrés.]

| ' | Sine. | Diff. | Tangent. | Diff. | Cotang. | Cosine. | D. | ' |
|----|---------|-------|----------|-------|----------|---------|-------|----|
| 0 | 9°23967 | 72 | 9°24532 | 74 | 10°75368 | 9°99335 | 2 | 60 |
| 1 | 9°24039 | 71 | 9°24606 | 73 | 10°75294 | 9°99333 | 2 | 59 |
| 2 | 9°24110 | 71 | 9°24679 | 74 | 10°75221 | 9°99331 | 3 | 58 |
| 3 | 9°24181 | 72 | 9°24753 | 74 | 10°75147 | 9°99328 | 3 | 57 |
| 4 | 9°24253 | 71 | 9°24826 | 73 | 10°75074 | 9°99326 | 2 | 56 |
| 5 | 9°24324 | 71 | 9°24900 | 73 | 10°75000 | 9°99324 | 2 | 55 |
| 6 | 9°24395 | 71 | 9°24973 | 73 | 10°74927 | 9°99322 | 3 | 54 |
| 7 | 9°24466 | 70 | 9°25046 | 73 | 10°74854 | 9°99319 | 2 | 53 |
| 8 | 9°24536 | 71 | 9°25119 | 73 | 10°74781 | 9°99317 | 2 | 52 |
| 9 | 9°24607 | 70 | 9°25192 | 73 | 10°74708 | 9°99315 | 2 | 51 |
| 10 | 9°24677 | 71 | 9°25265 | 72 | 10°74635 | 9°99313 | 3 | 50 |
| 11 | 9°24748 | 70 | 9°25337 | 73 | 10°74563 | 9°99310 | 2 | 49 |
| 12 | 9°24818 | 70 | 9°25410 | 72 | 10°74490 | 9°99308 | 2 | 48 |
| 13 | 9°24888 | 70 | 9°25482 | 73 | 10°74418 | 9°99306 | 2 | 47 |
| 14 | 9°24958 | 70 | 9°25555 | 72 | 10°74345 | 9°99304 | 3 | 46 |
| 15 | 9°25028 | 70 | 9°25627 | 72 | 10°74273 | 9°99301 | 2 | 45 |
| 16 | 9°25098 | 70 | 9°25699 | 72 | 10°74201 | 9°99299 | 2 | 44 |
| 17 | 9°25168 | 69 | 9°25771 | 72 | 10°74129 | 9°99297 | 3 | 43 |
| 18 | 9°25237 | 69 | 9°25843 | 72 | 10°74057 | 9°99294 | 2 | 42 |
| 19 | 9°25307 | 69 | 9°25915 | 71 | 10°73985 | 9°99292 | 2 | 41 |
| 20 | 9°25376 | 69 | 9°25986 | 72 | 10°73914 | 9°99290 | 2 | 40 |
| 21 | 9°25445 | 69 | 9°26058 | 71 | 10°73842 | 9°99288 | 3 | 39 |
| 22 | 9°25514 | 69 | 9°26129 | 72 | 10°73771 | 9°99285 | 2 | 38 |
| 23 | 9°25583 | 69 | 9°26201 | 71 | 10°73699 | 9°99283 | 2 | 37 |
| 24 | 9°25652 | 69 | 9°26272 | 71 | 10°73628 | 9°99281 | 3 | 36 |
| 25 | 9°25721 | 69 | 9°26343 | 71 | 10°73557 | 9°99278 | 2 | 35 |
| 26 | 9°25790 | 68 | 9°26414 | 71 | 10°73486 | 9°99276 | 2 | 34 |
| 27 | 9°25858 | 69 | 9°26485 | 70 | 10°73415 | 9°99274 | 2 | 33 |
| 28 | 9°25927 | 68 | 9°26555 | 71 | 10°73345 | 9°99271 | 2 | 32 |
| 29 | 9°25995 | 68 | 9°26626 | 71 | 10°73274 | 9°99269 | 2 | 31 |
| 30 | 9°26063 | | 9°26697 | | 10°73203 | 9°99267 | 2 | 30 |
| ' | Cosine. | | Cotang. | | Tangent. | | Sine. | ' |

[79 degrees.]

[11 degrees.]

| ' | Sine. | Diff. | Tangent. | Diff. | Cotang. | Cosine. | D. | ' |
|----|---------|---------|----------|-------|----------|---------|----|----|
| 0 | 9°28060 | 65 | 9°28865 | 68 | 10°71135 | 9°99195 | 3 | 60 |
| 1 | 9°28125 | 65 | 9°28933 | 67 | 10°71067 | 9°99192 | 3 | 59 |
| 2 | 9°28190 | 64 | 9°29000 | 67 | 10°71000 | 9°99190 | 2 | 58 |
| 3 | 9°28254 | 65 | 9°29067 | 67 | 10°70933 | 9°99187 | 3 | 57 |
| 4 | 9°28319 | 65 | 9°29134 | 67 | 10°70866 | 9°99185 | 3 | 56 |
| 5 | 9°28384 | 64 | 9°29201 | 67 | 10°70799 | 9°99182 | 2 | 55 |
| 6 | 9°28448 | 64 | 9°29268 | 67 | 10°70732 | 9°99180 | 2 | 54 |
| 7 | 9°28512 | 65 | 9°29335 | 67 | 10°70665 | 9°99177 | 3 | 53 |
| 8 | 9°28577 | 64 | 9°29402 | 66 | 10°70598 | 9°99175 | 3 | 52 |
| 9 | 9°28641 | 64 | 9°29468 | 67 | 10°70532 | 9°99172 | 2 | 51 |
| 10 | 9°28705 | 64 | 9°29535 | 66 | 10°70465 | 9°99170 | 3 | 50 |
| 11 | 9°28769 | 64 | 9°29601 | 67 | 10°70399 | 9°99167 | 2 | 49 |
| 12 | 9°28833 | 63 | 9°29668 | 66 | 10°70332 | 9°99165 | 2 | 48 |
| 13 | 9°28896 | 64 | 9°29734 | 66 | 10°70266 | 9°99162 | 3 | 47 |
| 14 | 9°28960 | 64 | 9°29800 | 66 | 10°70200 | 9°99160 | 2 | 46 |
| 15 | 9°29024 | 63 | 9°29866 | 66 | 10°70134 | 9°99157 | 2 | 45 |
| 16 | 9°29087 | 63 | 9°29932 | 66 | 10°70068 | 9°99155 | 3 | 44 |
| 17 | 9°29150 | 64 | 9°29998 | 66 | 10°70002 | 9°99152 | 2 | 43 |
| 18 | 9°29214 | 63 | 9°30064 | 66 | 10°69936 | 9°99150 | 3 | 42 |
| 19 | 9°29277 | 63 | 9°30130 | 65 | 10°69870 | 9°99147 | 2 | 41 |
| 20 | 9°29340 | 63 | 9°30195 | 66 | 10°69805 | 9°99145 | 3 | 40 |
| 21 | 9°29403 | 63 | 9°30261 | 65 | 10°69739 | 9°99142 | 2 | 39 |
| 22 | 9°29466 | 63 | 9°30326 | 65 | 10°69674 | 9°99140 | 3 | 38 |
| 23 | 9°29529 | 62 | 9°30391 | 66 | 10°69609 | 9°99137 | 2 | 37 |
| 24 | 9°29591 | 63 | 9°30457 | 65 | 10°69543 | 9°99135 | 3 | 36 |
| 25 | 9°29654 | 62 | 9°30522 | 65 | 10°69478 | 9°99132 | 2 | 35 |
| 26 | 9°29716 | 63 | 9°30587 | 65 | 10°69413 | 9°99130 | 3 | 34 |
| 27 | 9°29779 | 62 | 9°30652 | 65 | 10°69348 | 9°99127 | 3 | 33 |
| 28 | 9°29841 | 62 | 9°30717 | 65 | 10°69283 | 9°99124 | 2 | 32 |
| 29 | 9°29903 | 63 | 9°30782 | 64 | 10°69218 | 9°99122 | 3 | 31 |
| 30 | 9°29966 | | 9°30846 | | 10°69154 | 9°99119 | 3 | 30 |
| ' | Cosine. | Cotang. | Tangent. | Sine. | | | | |

[78 degrees.]

[11 degrees.]

| ' | Sine. | Diff. | Tangent. | Diff. | Cotang. | Cosine. | D. | ' |
|----|---------|---------|----------|-------|----------|---------|----|----|
| 30 | 9°29966 | 62 | 9°30846 | 65 | 10°69154 | 9°99119 | 2 | 30 |
| 31 | 9°30028 | 62 | 9°30911 | 64 | 10°69089 | 9°99117 | 3 | 29 |
| 32 | 9°30090 | 61 | 9°30975 | 65 | 10°69025 | 9°99114 | 2 | 28 |
| 33 | 9°30151 | 62 | 9°31040 | 64 | 10°68960 | 9°99112 | 3 | 27 |
| 34 | 9°30213 | 62 | 9°31104 | 64 | 10°68896 | 9°99109 | 3 | 26 |
| 35 | 9°30275 | 61 | 9°31168 | 65 | 10°68832 | 9°99106 | 2 | 25 |
| 36 | 9°30336 | 62 | 9°31233 | 64 | 10°68767 | 9°99104 | 2 | 24 |
| 37 | 9°30398 | 61 | 9°31297 | 64 | 10°68703 | 9°99101 | 3 | 23 |
| 38 | 9°30459 | 62 | 9°31361 | 64 | 10°68639 | 9°99099 | 2 | 22 |
| 39 | 9°30521 | 61 | 9°31425 | 64 | 10°68575 | 9°99096 | 3 | 21 |
| 40 | 9°30582 | 61 | 9°31489 | 63 | 10°68511 | 9°99093 | 2 | 20 |
| 41 | 9°30643 | 61 | 9°31553 | 64 | 10°68448 | 9°99091 | 3 | 19 |
| 42 | 9°30704 | 61 | 9°31616 | 63 | 10°68384 | 9°99088 | 2 | 18 |
| 43 | 9°30765 | 61 | 9°31679 | 64 | 10°68321 | 9°99086 | 3 | 17 |
| 44 | 9°30826 | 61 | 9°31743 | 63 | 10°68257 | 9°99083 | 2 | 16 |
| 45 | 9°30887 | 60 | 9°31806 | 64 | 10°68194 | 9°99080 | 3 | 15 |
| 46 | 9°30947 | 61 | 9°31870 | 63 | 10°68130 | 9°99078 | 2 | 14 |
| 47 | 9°31008 | 60 | 9°31933 | 63 | 10°68067 | 9°99075 | 3 | 13 |
| 48 | 9°31068 | 61 | 9°31996 | 63 | 10°68004 | 9°99072 | 2 | 12 |
| 49 | 9°31129 | 60 | 9°32059 | 63 | 10°67941 | 9°99070 | 3 | 11 |
| 50 | 9°31189 | 61 | 9°32122 | 63 | 10°67878 | 9°99067 | 2 | 10 |
| 51 | 9°31250 | 60 | 9°32185 | 63 | 10°67815 | 9°99064 | 3 | 9 |
| 52 | 9°31310 | 60 | 9°32248 | 63 | 10°67752 | 9°99062 | 2 | 8 |
| 53 | 9°31370 | 60 | 9°32311 | 62 | 10°67689 | 9°99059 | 3 | 7 |
| 54 | 9°31430 | 60 | 9°32373 | 63 | 10°67627 | 9°99056 | 2 | 6 |
| 55 | 9°31490 | 59 | 9°32436 | 62 | 10°67564 | 9°99054 | 3 | 5 |
| 56 | 9°31549 | 60 | 9°32498 | 63 | 10°67502 | 9°99051 | 2 | 4 |
| 57 | 9°31609 | 60 | 9°32561 | 62 | 10°67439 | 9°99048 | 3 | 3 |
| 58 | 9°31669 | 59 | 9°32623 | 62 | 10°67377 | 9°99046 | 2 | 2 |
| 59 | 9°31728 | 60 | 9°32685 | 62 | 10°67315 | 9°99043 | 3 | 1 |
| 60 | 9°31788 | | 9°32747 | | 10°67253 | 9°99040 | 3 | 0 |
| ' | Cosine. | Cotang. | Tangent. | Sine. | | | | |

[78 degrees.]

[12 degrees.]

| ' | Sine. | Diff. | Tangent. | Diff. | Cotang. | Diff. | Cosine. | D. | ' |
|----|---------|-------|----------|-------|----------|-------|---------|----|----|
| 30 | 9'33534 | 57 | 9'34556 | 59 | 10'65424 | 59 | 9'98958 | 3 | 30 |
| 31 | 9'33591 | 56 | 9'34615 | 60 | 10'65465 | 60 | 9'98955 | 2 | 29 |
| 32 | 9'33647 | 57 | 9'34675 | 60 | 10'65505 | 60 | 9'98953 | 3 | 28 |
| 33 | 9'33704 | 57 | 9'34735 | 59 | 10'65545 | 59 | 9'98950 | 3 | 27 |
| 34 | 9'33761 | 57 | 9'34794 | 60 | 10'65586 | 60 | 9'98947 | 3 | 26 |
| 35 | 9'33818 | 57 | 9'34854 | 59 | 10'65626 | 59 | 9'98944 | 3 | 25 |
| 36 | 9'33874 | 56 | 9'34913 | 59 | 10'65667 | 59 | 9'98941 | 3 | 24 |
| 37 | 9'33931 | 56 | 9'34972 | 59 | 10'65708 | 59 | 9'98938 | 3 | 23 |
| 38 | 9'33987 | 56 | 9'35031 | 60 | 10'65749 | 60 | 9'98936 | 3 | 22 |
| 39 | 9'34043 | 57 | 9'35091 | 59 | 10'65789 | 59 | 9'98933 | 3 | 21 |
| 40 | 9'34100 | 56 | 9'35150 | 59 | 10'65830 | 59 | 9'98930 | 3 | 20 |
| 41 | 9'34156 | 56 | 9'35209 | 59 | 10'65871 | 59 | 9'98927 | 3 | 19 |
| 42 | 9'34212 | 56 | 9'35268 | 59 | 10'65912 | 59 | 9'98924 | 3 | 18 |
| 43 | 9'34268 | 56 | 9'35327 | 58 | 10'65953 | 58 | 9'98921 | 3 | 17 |
| 44 | 9'34324 | 56 | 9'35386 | 59 | 10'65994 | 59 | 9'98919 | 3 | 16 |
| 45 | 9'34380 | 56 | 9'35445 | 59 | 10'66035 | 59 | 9'98916 | 3 | 15 |
| 46 | 9'34436 | 55 | 9'35504 | 58 | 10'66076 | 58 | 9'98913 | 3 | 14 |
| 47 | 9'34491 | 56 | 9'35563 | 59 | 10'66117 | 59 | 9'98910 | 3 | 13 |
| 48 | 9'34547 | 55 | 9'35622 | 58 | 10'66158 | 58 | 9'98907 | 3 | 12 |
| 49 | 9'34602 | 55 | 9'35681 | 59 | 10'66199 | 59 | 9'98904 | 3 | 11 |
| 50 | 9'34658 | 55 | 9'35740 | 58 | 10'66240 | 58 | 9'98901 | 3 | 10 |
| 51 | 9'34713 | 56 | 9'35799 | 58 | 10'66281 | 58 | 9'98898 | 3 | 9 |
| 52 | 9'34769 | 55 | 9'35858 | 59 | 10'66322 | 59 | 9'98896 | 3 | 8 |
| 53 | 9'34824 | 55 | 9'35917 | 58 | 10'66363 | 58 | 9'98893 | 3 | 7 |
| 54 | 9'34879 | 55 | 9'35976 | 58 | 10'66404 | 58 | 9'98890 | 3 | 6 |
| 55 | 9'34934 | 55 | 9'36035 | 58 | 10'66445 | 58 | 9'98887 | 3 | 5 |
| 56 | 9'34989 | 55 | 9'36094 | 58 | 10'66486 | 58 | 9'98884 | 3 | 4 |
| 57 | 9'35044 | 55 | 9'36153 | 58 | 10'66527 | 58 | 9'98881 | 3 | 3 |
| 58 | 9'35099 | 55 | 9'36212 | 58 | 10'66568 | 58 | 9'98878 | 3 | 2 |
| 59 | 9'35154 | 55 | 9'36271 | 57 | 10'66609 | 57 | 9'98875 | 3 | 1 |
| 60 | 9'35209 | 55 | 9'36330 | 57 | 10'66650 | 57 | 9'98872 | 3 | 0 |
| ' | Cosine. | | Cotang. | | Tangent. | | Sine. | | ' |

[77 degrees.]

[12 degrees.]

| ' | Sine. | Diff. | Tangent. | Diff. | Cotang. | Diff. | Cosine. | D. | ' |
|----|---------|-------|----------|-------|----------|-------|---------|----|----|
| 0 | 9'31788 | 59 | 9'32747 | 63 | 10'67233 | 63 | 9'99040 | 2 | 60 |
| 1 | 9'31847 | 60 | 9'32810 | 62 | 10'67193 | 62 | 9'99038 | 3 | 59 |
| 2 | 9'31907 | 59 | 9'32872 | 61 | 10'67152 | 61 | 9'99035 | 3 | 58 |
| 3 | 9'31966 | 59 | 9'32933 | 62 | 10'67067 | 62 | 9'99032 | 3 | 57 |
| 4 | 9'32025 | 59 | 9'32995 | 62 | 10'67005 | 62 | 9'99030 | 3 | 56 |
| 5 | 9'32084 | 59 | 9'33057 | 62 | 10'66943 | 62 | 9'99027 | 3 | 55 |
| 6 | 9'32143 | 59 | 9'33119 | 61 | 10'66881 | 61 | 9'99024 | 3 | 54 |
| 7 | 9'32202 | 59 | 9'33180 | 62 | 10'66820 | 62 | 9'99022 | 3 | 53 |
| 8 | 9'32261 | 59 | 9'33242 | 61 | 10'66758 | 61 | 9'99019 | 3 | 52 |
| 9 | 9'32319 | 58 | 9'33303 | 62 | 10'66697 | 62 | 9'99016 | 3 | 51 |
| 10 | 9'32378 | 59 | 9'33365 | 61 | 10'66635 | 61 | 9'99013 | 3 | 50 |
| 11 | 9'32437 | 58 | 9'33426 | 61 | 10'66574 | 61 | 9'99011 | 3 | 49 |
| 12 | 9'32495 | 58 | 9'33487 | 61 | 10'66513 | 61 | 9'99008 | 3 | 48 |
| 13 | 9'32553 | 59 | 9'33548 | 61 | 10'66452 | 61 | 9'99005 | 3 | 47 |
| 14 | 9'32612 | 58 | 9'33609 | 61 | 10'66391 | 61 | 9'99002 | 3 | 46 |
| 15 | 9'32670 | 58 | 9'33670 | 61 | 10'66330 | 61 | 9'99000 | 3 | 45 |
| 16 | 9'32728 | 58 | 9'33731 | 61 | 10'66269 | 61 | 9'98997 | 3 | 44 |
| 17 | 9'32786 | 58 | 9'33792 | 61 | 10'66208 | 61 | 9'98994 | 3 | 43 |
| 18 | 9'32844 | 58 | 9'33853 | 61 | 10'66147 | 61 | 9'98991 | 3 | 42 |
| 19 | 9'32902 | 58 | 9'33913 | 61 | 10'66087 | 61 | 9'98988 | 3 | 41 |
| 20 | 9'32960 | 58 | 9'33974 | 60 | 10'66026 | 60 | 9'98986 | 3 | 40 |
| 21 | 9'33018 | 57 | 9'34034 | 61 | 10'65966 | 61 | 9'98983 | 3 | 39 |
| 22 | 9'33075 | 58 | 9'34095 | 60 | 10'65905 | 60 | 9'98980 | 3 | 38 |
| 23 | 9'33133 | 57 | 9'34155 | 60 | 10'65845 | 60 | 9'98978 | 3 | 37 |
| 24 | 9'33190 | 57 | 9'34215 | 61 | 10'65785 | 61 | 9'98975 | 3 | 36 |
| 25 | 9'33248 | 57 | 9'34276 | 60 | 10'65724 | 60 | 9'98972 | 3 | 35 |
| 26 | 9'33305 | 57 | 9'34336 | 60 | 10'65664 | 60 | 9'98969 | 3 | 34 |
| 27 | 9'33362 | 58 | 9'34396 | 60 | 10'65604 | 60 | 9'98967 | 3 | 33 |
| 28 | 9'33420 | 57 | 9'34456 | 60 | 10'65544 | 60 | 9'98964 | 3 | 32 |
| 29 | 9'33477 | 57 | 9'34516 | 60 | 10'65484 | 60 | 9'98961 | 3 | 31 |
| 30 | 9'33534 | 57 | 9'34576 | 60 | 10'65424 | 60 | 9'98958 | 3 | 30 |
| ' | Cosine. | | Cotang. | | Tangent. | | Sine. | | ' |

[77 degrees.]

[13 degrees.]

| ' | Sine. | Dif. | Tangent. | Dif. | Cotang. | Cotang. | Cosine. | ' |
|----|---------|------|----------|------|----------|---------|---------|----|
| 30 | 9.36819 | 52 | 9.38035 | 56 | 10.61965 | 9.98783 | 3 | 30 |
| 31 | 9.36871 | 53 | 9.38091 | 56 | 10.61909 | 9.98780 | 3 | 29 |
| 32 | 9.36924 | 53 | 9.38147 | 55 | 10.61853 | 9.98777 | 3 | 28 |
| 33 | 9.36976 | 52 | 9.38202 | 55 | 10.61798 | 9.98774 | 3 | 27 |
| 34 | 9.37028 | 53 | 9.38257 | 56 | 10.61743 | 9.98771 | 3 | 26 |
| 35 | 9.37081 | 52 | 9.38313 | 55 | 10.61687 | 9.98768 | 3 | 25 |
| 36 | 9.37133 | 52 | 9.38368 | 55 | 10.61632 | 9.98765 | 3 | 24 |
| 37 | 9.37185 | 52 | 9.38423 | 56 | 10.61577 | 9.98762 | 3 | 23 |
| 38 | 9.37237 | 52 | 9.38479 | 55 | 10.61521 | 9.98759 | 3 | 22 |
| 39 | 9.37289 | 52 | 9.38534 | 55 | 10.61466 | 9.98756 | 3 | 21 |
| 40 | 9.37341 | 52 | 9.38589 | 55 | 10.61411 | 9.98753 | 3 | 20 |
| 41 | 9.37393 | 52 | 9.38644 | 55 | 10.61356 | 9.98750 | 3 | 19 |
| 42 | 9.37445 | 52 | 9.38699 | 55 | 10.61301 | 9.98746 | 3 | 18 |
| 43 | 9.37497 | 52 | 9.38754 | 54 | 10.61246 | 9.98743 | 3 | 17 |
| 44 | 9.37549 | 51 | 9.38808 | 55 | 10.61192 | 9.98740 | 3 | 16 |
| 45 | 9.37600 | 52 | 9.38863 | 55 | 10.61137 | 9.98737 | 3 | 15 |
| 46 | 9.37652 | 51 | 9.38918 | 54 | 10.61082 | 9.98734 | 3 | 14 |
| 47 | 9.37703 | 52 | 9.38973 | 55 | 10.61028 | 9.98731 | 3 | 13 |
| 48 | 9.37755 | 51 | 9.39027 | 55 | 10.60973 | 9.98728 | 3 | 12 |
| 49 | 9.37806 | 52 | 9.39082 | 54 | 10.60918 | 9.98725 | 3 | 11 |
| 50 | 9.37858 | 51 | 9.39136 | 54 | 10.60864 | 9.98722 | 3 | 10 |
| 51 | 9.37909 | 51 | 9.39190 | 55 | 10.60810 | 9.98719 | 3 | 9 |
| 52 | 9.37960 | 51 | 9.39245 | 54 | 10.60755 | 9.98715 | 3 | 8 |
| 53 | 9.38011 | 51 | 9.39299 | 54 | 10.60701 | 9.98712 | 3 | 7 |
| 54 | 9.38062 | 51 | 9.39353 | 54 | 10.60647 | 9.98709 | 3 | 6 |
| 55 | 9.38113 | 51 | 9.39407 | 54 | 10.60593 | 9.98706 | 3 | 5 |
| 56 | 9.38164 | 51 | 9.39461 | 54 | 10.60539 | 9.98703 | 3 | 4 |
| 57 | 9.38215 | 51 | 9.39515 | 54 | 10.60485 | 9.98700 | 3 | 3 |
| 58 | 9.38266 | 51 | 9.39569 | 54 | 10.60431 | 9.98697 | 3 | 2 |
| 59 | 9.38317 | 51 | 9.39623 | 54 | 10.60377 | 9.98694 | 3 | 1 |
| 60 | 9.38368 | 51 | 9.39677 | 54 | 10.60323 | 9.98690 | 3 | 0 |
| ' | Cosine. | | Cotang. | | Tangent. | Sine. | | ' |

[76 degrees.]

[13 degrees.]

| ' | Sine. | Dif. | Tangent. | Dif. | Cotang. | Cosine. | D. | ' |
|----|---------|------|----------|------|----------|---------|----|----|
| 0 | 9.33209 | 54 | 9.33636 | 58 | 10.63664 | 9.98872 | 3 | 59 |
| 1 | 9.33261 | 55 | 9.33694 | 58 | 10.63606 | 9.98869 | 3 | 58 |
| 2 | 9.33318 | 55 | 9.33752 | 57 | 10.63548 | 9.98867 | 3 | 57 |
| 3 | 9.33373 | 54 | 9.33809 | 57 | 10.63491 | 9.98864 | 3 | 56 |
| 4 | 9.33427 | 54 | 9.33866 | 58 | 10.63434 | 9.98861 | 3 | 55 |
| 5 | 9.33481 | 55 | 9.33924 | 57 | 10.63376 | 9.98858 | 3 | 54 |
| 6 | 9.33536 | 54 | 9.33981 | 57 | 10.63319 | 9.98855 | 3 | 53 |
| 7 | 9.33590 | 54 | 9.34038 | 57 | 10.63262 | 9.98852 | 3 | 52 |
| 8 | 9.33644 | 54 | 9.34095 | 57 | 10.63205 | 9.98849 | 3 | 51 |
| 9 | 9.33698 | 54 | 9.34152 | 57 | 10.63148 | 9.98846 | 3 | 50 |
| 10 | 9.33752 | 54 | 9.34209 | 57 | 10.63091 | 9.98843 | 3 | 49 |
| 11 | 9.33806 | 54 | 9.34266 | 56 | 10.63034 | 9.98840 | 3 | 48 |
| 12 | 9.33860 | 54 | 9.34323 | 57 | 10.62977 | 9.98837 | 3 | 47 |
| 13 | 9.33914 | 54 | 9.34380 | 57 | 10.62920 | 9.98834 | 3 | 46 |
| 14 | 9.33968 | 54 | 9.34437 | 56 | 10.62863 | 9.98831 | 3 | 45 |
| 15 | 9.34022 | 53 | 9.34493 | 57 | 10.62807 | 9.98828 | 3 | 44 |
| 16 | 9.34075 | 54 | 9.34550 | 56 | 10.62750 | 9.98825 | 3 | 43 |
| 17 | 9.34129 | 53 | 9.34606 | 57 | 10.62694 | 9.98822 | 3 | 42 |
| 18 | 9.34182 | 54 | 9.34663 | 56 | 10.62637 | 9.98819 | 3 | 41 |
| 19 | 9.34236 | 53 | 9.34719 | 57 | 10.62581 | 9.98816 | 3 | 40 |
| 20 | 9.34289 | 53 | 9.34776 | 56 | 10.62524 | 9.98813 | 3 | 39 |
| 21 | 9.34342 | 53 | 9.34832 | 56 | 10.62468 | 9.98810 | 3 | 38 |
| 22 | 9.34395 | 54 | 9.34888 | 56 | 10.62412 | 9.98807 | 3 | 37 |
| 23 | 9.34449 | 53 | 9.34944 | 56 | 10.62356 | 9.98804 | 3 | 36 |
| 24 | 9.34502 | 53 | 9.34999 | 56 | 10.62300 | 9.98801 | 3 | 35 |
| 25 | 9.34555 | 53 | 9.35055 | 56 | 10.62244 | 9.98798 | 3 | 34 |
| 26 | 9.34608 | 52 | 9.35112 | 56 | 10.62188 | 9.98795 | 3 | 33 |
| 27 | 9.34660 | 53 | 9.35168 | 56 | 10.62132 | 9.98792 | 3 | 32 |
| 28 | 9.34713 | 53 | 9.35224 | 56 | 10.62076 | 9.98789 | 3 | 31 |
| 29 | 9.34766 | 53 | 9.35280 | 55 | 10.62020 | 9.98786 | 3 | 30 |
| 30 | 9.34819 | | 9.35335 | | 10.61965 | 9.98783 | 3 | |
| ' | Cosine. | | Cotang. | | Tangent. | Sine. | | ' |

[76 degrees.]

[14 degrees.]

| | Sine. | Tangent. | Diff. | Cotang. | Cosine. | D. | |
|----|---------|----------|-------|----------|---------|----|----|
| 30 | 9.39860 | 9.41266 | 49 | 10.58734 | 9.98594 | 3 | 30 |
| 31 | 9.39909 | 9.41318 | 49 | 10.58682 | 9.98591 | 3 | 29 |
| 32 | 9.39958 | 9.41370 | 48 | 10.58630 | 9.98588 | 3 | 28 |
| 33 | 9.40006 | 9.41422 | 48 | 10.58578 | 9.98584 | 4 | 27 |
| 34 | 9.40055 | 9.41474 | 48 | 10.58526 | 9.98581 | 3 | 26 |
| 35 | 9.40103 | 9.41526 | 48 | 10.58474 | 9.98578 | 3 | 25 |
| 36 | 9.40152 | 9.41578 | 48 | 10.58422 | 9.98574 | 4 | 24 |
| 37 | 9.40200 | 9.41630 | 48 | 10.58371 | 9.98571 | 3 | 23 |
| 38 | 9.40249 | 9.41681 | 48 | 10.58319 | 9.98568 | 3 | 22 |
| 39 | 9.40297 | 9.41733 | 48 | 10.58267 | 9.98565 | 3 | 21 |
| 40 | 9.40346 | 9.41784 | 48 | 10.58216 | 9.98561 | 4 | 20 |
| 41 | 9.40394 | 9.41836 | 48 | 10.58164 | 9.98558 | 3 | 19 |
| 42 | 9.40442 | 9.41887 | 48 | 10.58113 | 9.98555 | 3 | 18 |
| 43 | 9.40490 | 9.41939 | 48 | 10.58061 | 9.98551 | 3 | 17 |
| 44 | 9.40538 | 9.41990 | 48 | 10.58010 | 9.98548 | 3 | 16 |
| 45 | 9.40586 | 9.42041 | 48 | 10.57959 | 9.98545 | 4 | 15 |
| 46 | 9.40634 | 9.42093 | 48 | 10.57907 | 9.98541 | 4 | 14 |
| 47 | 9.40682 | 9.42144 | 48 | 10.57856 | 9.98538 | 3 | 13 |
| 48 | 9.40730 | 9.42195 | 48 | 10.57805 | 9.98535 | 3 | 12 |
| 49 | 9.40778 | 9.42246 | 47 | 10.57754 | 9.98531 | 4 | 11 |
| 50 | 9.40825 | 9.42297 | 48 | 10.57703 | 9.98528 | 3 | 10 |
| 51 | 9.40873 | 9.42348 | 48 | 10.57652 | 9.98525 | 3 | 9 |
| 52 | 9.40921 | 9.42399 | 47 | 10.57601 | 9.98521 | 4 | 8 |
| 53 | 9.40968 | 9.42450 | 48 | 10.57550 | 9.98518 | 3 | 7 |
| 54 | 9.41016 | 9.42501 | 47 | 10.57499 | 9.98515 | 3 | 6 |
| 55 | 9.41063 | 9.42552 | 48 | 10.57448 | 9.98511 | 4 | 5 |
| 56 | 9.41111 | 9.42603 | 47 | 10.57397 | 9.98508 | 3 | 4 |
| 57 | 9.41158 | 9.42653 | 47 | 10.57347 | 9.98505 | 3 | 3 |
| 58 | 9.41205 | 9.42704 | 47 | 10.57296 | 9.98501 | 4 | 2 |
| 59 | 9.41252 | 9.42755 | 48 | 10.57245 | 9.98498 | 3 | 1 |
| 60 | 9.41300 | 9.42805 | 48 | 10.57195 | 9.98494 | 4 | 0 |
| | Cosine. | Cotang. | | Tangent. | Sine. | | |

[75 degrees.]

[14 degrees.]

| | Sine. | Tangent. | Diff. | Cotang. | Cosine. | D. | |
|----|---------|----------|-------|----------|---------|----|----|
| 0 | 9.38368 | 9.39677 | 54 | 10.60323 | 9.98690 | 3 | 60 |
| 1 | 9.38418 | 9.39731 | 54 | 10.60269 | 9.98687 | 3 | 59 |
| 2 | 9.38469 | 9.39785 | 53 | 10.60215 | 9.98684 | 3 | 58 |
| 3 | 9.38519 | 9.39838 | 54 | 10.60162 | 9.98681 | 3 | 57 |
| 4 | 9.38570 | 9.39892 | 54 | 10.60108 | 9.98678 | 3 | 56 |
| 5 | 9.38620 | 9.39945 | 54 | 10.60055 | 9.98675 | 3 | 55 |
| 6 | 9.38670 | 9.39999 | 53 | 10.60001 | 9.98671 | 4 | 54 |
| 7 | 9.38721 | 9.40052 | 54 | 10.59948 | 9.98668 | 3 | 53 |
| 8 | 9.38771 | 9.40106 | 53 | 10.59894 | 9.98665 | 3 | 52 |
| 9 | 9.38821 | 9.40159 | 53 | 10.59841 | 9.98662 | 3 | 51 |
| 10 | 9.38871 | 9.40212 | 54 | 10.59788 | 9.98659 | 3 | 50 |
| 11 | 9.38921 | 9.40266 | 53 | 10.59734 | 9.98656 | 3 | 49 |
| 12 | 9.38971 | 9.40319 | 53 | 10.59681 | 9.98652 | 4 | 48 |
| 13 | 9.39021 | 9.40372 | 53 | 10.59628 | 9.98649 | 3 | 47 |
| 14 | 9.39071 | 9.40425 | 53 | 10.59575 | 9.98646 | 3 | 46 |
| 15 | 9.39121 | 9.40478 | 53 | 10.59522 | 9.98643 | 3 | 45 |
| 16 | 9.39170 | 9.40531 | 53 | 10.59469 | 9.98640 | 3 | 44 |
| 17 | 9.39220 | 9.40584 | 52 | 10.59416 | 9.98636 | 4 | 43 |
| 18 | 9.39270 | 9.40636 | 53 | 10.59364 | 9.98633 | 3 | 42 |
| 19 | 9.39319 | 9.40689 | 53 | 10.59311 | 9.98630 | 3 | 41 |
| 20 | 9.39369 | 9.40742 | 53 | 10.59258 | 9.98627 | 3 | 40 |
| 21 | 9.39418 | 9.40795 | 52 | 10.59205 | 9.98623 | 4 | 39 |
| 22 | 9.39467 | 9.40847 | 53 | 10.59153 | 9.98620 | 3 | 38 |
| 23 | 9.39517 | 9.40900 | 52 | 10.59100 | 9.98617 | 3 | 37 |
| 24 | 9.39566 | 9.40952 | 53 | 10.59048 | 9.98614 | 4 | 36 |
| 25 | 9.39615 | 9.41005 | 52 | 10.58995 | 9.98610 | 3 | 35 |
| 26 | 9.39664 | 9.41057 | 52 | 10.58943 | 9.98607 | 3 | 34 |
| 27 | 9.39713 | 9.41109 | 52 | 10.58891 | 9.98604 | 3 | 33 |
| 28 | 9.39762 | 9.41161 | 52 | 10.58839 | 9.98601 | 4 | 32 |
| 29 | 9.39811 | 9.41214 | 53 | 10.58786 | 9.98597 | 3 | 31 |
| 30 | 9.39860 | 9.41266 | 52 | 10.58734 | 9.98594 | 3 | 30 |
| | Cosine. | Cotang. | | Tangent. | Sine. | | |

[75 degrees.]

[15 degrees.]

| ' | Sine. | Diff. | Tangent. | Diff. | Cotang. | Gosine. | D. | ' |
|----|---------|-------|----------|-------|----------|---------|----|----|
| 30 | 9'42690 | 45 | 9'44299 | 45 | 10'55701 | 9'98391 | 3 | 30 |
| 31 | 9'42735 | 46 | 9'44348 | 46 | 10'55652 | 9'98388 | 4 | 29 |
| 32 | 9'42781 | 45 | 9'44397 | 45 | 10'55603 | 9'98384 | 5 | 28 |
| 33 | 9'42826 | 46 | 9'44446 | 46 | 10'55554 | 9'98381 | 6 | 27 |
| 34 | 9'42872 | 45 | 9'44495 | 45 | 10'55505 | 9'98377 | 7 | 26 |
| 35 | 9'42917 | 45 | 9'44544 | 45 | 10'55456 | 9'98373 | 8 | 25 |
| 36 | 9'42962 | 46 | 9'44592 | 46 | 10'55408 | 9'98370 | 9 | 24 |
| 37 | 9'43008 | 45 | 9'44641 | 45 | 10'55359 | 9'98366 | 10 | 23 |
| 38 | 9'43053 | 45 | 9'44690 | 45 | 10'55310 | 9'98363 | 11 | 22 |
| 39 | 9'43098 | 45 | 9'44738 | 45 | 10'55262 | 9'98359 | 12 | 21 |
| 40 | 9'43143 | 45 | 9'44787 | 45 | 10'55213 | 9'98356 | 13 | 20 |
| 41 | 9'43188 | 45 | 9'44836 | 45 | 10'55164 | 9'98352 | 14 | 19 |
| 42 | 9'43233 | 45 | 9'44884 | 45 | 10'55116 | 9'98349 | 15 | 18 |
| 43 | 9'43278 | 45 | 9'44933 | 45 | 10'55067 | 9'98345 | 16 | 17 |
| 44 | 9'43323 | 44 | 9'44981 | 44 | 10'55019 | 9'98342 | 17 | 16 |
| 45 | 9'43367 | 45 | 9'45029 | 45 | 10'54971 | 9'98338 | 18 | 15 |
| 46 | 9'43412 | 45 | 9'45078 | 45 | 10'54922 | 9'98334 | 19 | 14 |
| 47 | 9'43457 | 45 | 9'45126 | 45 | 10'54874 | 9'98331 | 20 | 13 |
| 48 | 9'43502 | 44 | 9'45174 | 44 | 10'54826 | 9'98327 | 21 | 12 |
| 49 | 9'43546 | 45 | 9'45222 | 45 | 10'54778 | 9'98324 | 22 | 11 |
| 50 | 9'43591 | 44 | 9'45271 | 44 | 10'54729 | 9'98320 | 23 | 10 |
| 51 | 9'43635 | 45 | 9'45319 | 45 | 10'54681 | 9'98317 | 24 | 9 |
| 52 | 9'43680 | 44 | 9'45367 | 44 | 10'54633 | 9'98313 | 25 | 8 |
| 53 | 9'43724 | 45 | 9'45415 | 45 | 10'54585 | 9'98309 | 26 | 7 |
| 54 | 9'43769 | 44 | 9'45463 | 44 | 10'54537 | 9'98306 | 27 | 6 |
| 55 | 9'43813 | 44 | 9'45511 | 44 | 10'54489 | 9'98302 | 28 | 5 |
| 56 | 9'43857 | 44 | 9'45559 | 44 | 10'54441 | 9'98299 | 29 | 4 |
| 57 | 9'43901 | 45 | 9'45606 | 45 | 10'54394 | 9'98295 | 30 | 3 |
| 58 | 9'43946 | 44 | 9'45654 | 44 | 10'54346 | 9'98291 | 31 | 2 |
| 59 | 9'43990 | 44 | 9'45702 | 44 | 10'54298 | 9'98288 | 32 | 1 |
| 60 | 9'44034 | 44 | 9'45750 | 44 | 10'54250 | 9'98284 | 33 | 0 |
| ' | Cosine. | | Cotang. | | Tangent. | Sine. | | ' |

[74 degrees.]

[15 degrees.]

| ' | Sine. | Diff. | Tangent. | Diff. | Cotang. | Gosine. | D. | ' |
|----|---------|-------|----------|-------|----------|---------|----|----|
| 0 | 9'41300 | 47 | 9'42805 | 51 | 10'57195 | 9'98494 | 3 | 60 |
| 1 | 9'41347 | 47 | 9'42856 | 50 | 10'57144 | 9'98491 | 4 | 59 |
| 2 | 9'41394 | 47 | 9'42906 | 51 | 10'57094 | 9'98488 | 5 | 58 |
| 3 | 9'41441 | 47 | 9'42957 | 50 | 10'57043 | 9'98484 | 6 | 57 |
| 4 | 9'41488 | 47 | 9'43007 | 50 | 10'56993 | 9'98481 | 7 | 56 |
| 5 | 9'41535 | 47 | 9'43057 | 51 | 10'56943 | 9'98477 | 8 | 55 |
| 6 | 9'41582 | 46 | 9'43108 | 50 | 10'56892 | 9'98474 | 9 | 54 |
| 7 | 9'41628 | 47 | 9'43158 | 50 | 10'56842 | 9'98471 | 10 | 53 |
| 8 | 9'41675 | 47 | 9'43208 | 50 | 10'56792 | 9'98467 | 11 | 52 |
| 9 | 9'41722 | 46 | 9'43258 | 50 | 10'56742 | 9'98464 | 12 | 51 |
| 10 | 9'41769 | 47 | 9'43308 | 50 | 10'56692 | 9'98460 | 13 | 50 |
| 11 | 9'41815 | 46 | 9'43358 | 50 | 10'56642 | 9'98457 | 14 | 49 |
| 12 | 9'41861 | 47 | 9'43408 | 50 | 10'56592 | 9'98453 | 15 | 48 |
| 13 | 9'41908 | 46 | 9'43458 | 50 | 10'56542 | 9'98450 | 16 | 47 |
| 14 | 9'41954 | 47 | 9'43508 | 50 | 10'56492 | 9'98447 | 17 | 46 |
| 15 | 9'42001 | 46 | 9'43558 | 49 | 10'56442 | 9'98443 | 18 | 45 |
| 16 | 9'42047 | 46 | 9'43607 | 50 | 10'56393 | 9'98440 | 19 | 44 |
| 17 | 9'42093 | 47 | 9'43657 | 50 | 10'56343 | 9'98436 | 20 | 43 |
| 18 | 9'42140 | 46 | 9'43707 | 49 | 10'56293 | 9'98433 | 21 | 42 |
| 19 | 9'42186 | 46 | 9'43756 | 50 | 10'56244 | 9'98429 | 22 | 41 |
| 20 | 9'42232 | 46 | 9'43806 | 49 | 10'56194 | 9'98426 | 23 | 40 |
| 21 | 9'42278 | 46 | 9'43855 | 50 | 10'56145 | 9'98422 | 24 | 39 |
| 22 | 9'42324 | 46 | 9'43905 | 49 | 10'56095 | 9'98419 | 25 | 38 |
| 23 | 9'42370 | 46 | 9'43954 | 50 | 10'56046 | 9'98415 | 26 | 37 |
| 24 | 9'42416 | 45 | 9'44004 | 49 | 10'55996 | 9'98412 | 27 | 36 |
| 25 | 9'42461 | 46 | 9'44053 | 49 | 10'55947 | 9'98409 | 28 | 35 |
| 26 | 9'42507 | 46 | 9'44102 | 49 | 10'55898 | 9'98405 | 29 | 34 |
| 27 | 9'42553 | 45 | 9'44151 | 50 | 10'55849 | 9'98402 | 30 | 33 |
| 28 | 9'42599 | 45 | 9'44201 | 49 | 10'55799 | 9'98398 | 31 | 32 |
| 29 | 9'42644 | 46 | 9'44250 | 49 | 10'55750 | 9'98395 | 32 | 31 |
| 30 | 9'42690 | 46 | 9'44299 | 49 | 10'55701 | 9'98391 | 33 | 30 |
| ' | Cosine. | | Cotang. | | Tangent. | Sine. | | ' |

[74 degrees.]

[16 degrees.]

| ' | Sine | Diff. | Tangent. | Diff. | Cotang. | Cosine. | ' |
|----|---------|-------|----------|-------|----------|---------|----|
| 0 | 9'44034 | 44 | 9'45750 | 47 | 10'54250 | 9'98284 | 60 |
| 1 | 9'44078 | 44 | 9'45797 | 48 | 10'54203 | 9'98281 | 59 |
| 2 | 9'44122 | 44 | 9'45845 | 47 | 10'54155 | 9'98277 | 58 |
| 3 | 9'44166 | 44 | 9'45892 | 47 | 10'54108 | 9'98273 | 57 |
| 4 | 9'44210 | 44 | 9'45940 | 48 | 10'54060 | 9'98270 | 56 |
| 5 | 9'44253 | 44 | 9'45987 | 47 | 10'54013 | 9'98266 | 55 |
| 6 | 9'44297 | 44 | 9'46035 | 47 | 10'53965 | 9'98262 | 54 |
| 7 | 9'44341 | 44 | 9'46082 | 48 | 10'53918 | 9'98259 | 53 |
| 8 | 9'44385 | 44 | 9'46130 | 47 | 10'53870 | 9'98255 | 52 |
| 9 | 9'44428 | 43 | 9'46177 | 47 | 10'53823 | 9'98251 | 51 |
| 10 | 9'44472 | 44 | 9'46224 | 47 | 10'53776 | 9'98248 | 50 |
| 11 | 9'44516 | 44 | 9'46271 | 48 | 10'53729 | 9'98244 | 49 |
| 12 | 9'44559 | 43 | 9'46319 | 47 | 10'53681 | 9'98240 | 48 |
| 13 | 9'44602 | 44 | 9'46366 | 47 | 10'53634 | 9'98237 | 47 |
| 14 | 9'44646 | 43 | 9'46413 | 47 | 10'53587 | 9'98233 | 46 |
| 15 | 9'44689 | 44 | 9'46460 | 47 | 10'53540 | 9'98229 | 45 |
| 16 | 9'44733 | 43 | 9'46507 | 47 | 10'53493 | 9'98226 | 44 |
| 17 | 9'44776 | 43 | 9'46554 | 47 | 10'53446 | 9'98222 | 43 |
| 18 | 9'44819 | 43 | 9'46601 | 47 | 10'53399 | 9'98218 | 42 |
| 19 | 9'44862 | 43 | 9'46648 | 46 | 10'53352 | 9'98215 | 41 |
| 20 | 9'44905 | 43 | 9'46694 | 47 | 10'53306 | 9'98211 | 40 |
| 21 | 9'44948 | 44 | 9'46741 | 47 | 10'53259 | 9'98207 | 39 |
| 22 | 9'44992 | 43 | 9'46788 | 47 | 10'53212 | 9'98204 | 38 |
| 23 | 9'45035 | 43 | 9'46835 | 46 | 10'53165 | 9'98200 | 37 |
| 24 | 9'45077 | 42 | 9'46881 | 47 | 10'53119 | 9'98196 | 36 |
| 25 | 9'45120 | 43 | 9'46928 | 47 | 10'53072 | 9'98192 | 35 |
| 26 | 9'45163 | 43 | 9'46975 | 46 | 10'53025 | 9'98189 | 34 |
| 27 | 9'45206 | 43 | 9'47021 | 47 | 10'52979 | 9'98185 | 33 |
| 28 | 9'45249 | 42 | 9'47068 | 46 | 10'52932 | 9'98181 | 32 |
| 29 | 9'45292 | 43 | 9'47114 | 46 | 10'52886 | 9'98177 | 31 |
| 30 | 9'45334 | 42 | 9'47160 | 46 | 10'52840 | 9'98174 | 30 |

[73 degrees.]

[16 degrees.]

| ' | Sine | Diff. | Tangent. | Diff. | Cotang. | Cosine. | ' |
|----|---------|-------|----------|-------|----------|---------|----|
| 30 | 9'45334 | 43 | 9'47160 | 47 | 10'52840 | 9'98174 | 30 |
| 31 | 9'45377 | 42 | 9'47207 | 46 | 10'52793 | 9'98170 | 29 |
| 32 | 9'45419 | 43 | 9'47253 | 46 | 10'52747 | 9'98166 | 28 |
| 33 | 9'45462 | 42 | 9'47299 | 47 | 10'52701 | 9'98162 | 27 |
| 34 | 9'45504 | 43 | 9'47346 | 46 | 10'52654 | 9'98159 | 26 |
| 35 | 9'45547 | 42 | 9'47392 | 46 | 10'52608 | 9'98155 | 25 |
| 36 | 9'45589 | 43 | 9'47438 | 46 | 10'52562 | 9'98151 | 24 |
| 37 | 9'45632 | 42 | 9'47484 | 46 | 10'52516 | 9'98147 | 23 |
| 38 | 9'45674 | 42 | 9'47530 | 46 | 10'52470 | 9'98144 | 22 |
| 39 | 9'45716 | 42 | 9'47576 | 46 | 10'52424 | 9'98140 | 21 |
| 40 | 9'45758 | 43 | 9'47622 | 46 | 10'52378 | 9'98136 | 20 |
| 41 | 9'45801 | 42 | 9'47668 | 46 | 10'52332 | 9'98132 | 19 |
| 42 | 9'45843 | 42 | 9'47714 | 46 | 10'52286 | 9'98129 | 18 |
| 43 | 9'45885 | 42 | 9'47760 | 46 | 10'52240 | 9'98125 | 17 |
| 44 | 9'45927 | 42 | 9'47806 | 46 | 10'52194 | 9'98121 | 16 |
| 45 | 9'45969 | 42 | 9'47852 | 45 | 10'52148 | 9'98117 | 15 |
| 46 | 9'46011 | 42 | 9'47897 | 46 | 10'52103 | 9'98113 | 14 |
| 47 | 9'46053 | 42 | 9'47943 | 46 | 10'52057 | 9'98110 | 13 |
| 48 | 9'46095 | 41 | 9'47989 | 46 | 10'52011 | 9'98106 | 12 |
| 49 | 9'46136 | 42 | 9'48035 | 45 | 10'51965 | 9'98102 | 11 |
| 50 | 9'46178 | 42 | 9'48080 | 46 | 10'51920 | 9'98098 | 10 |
| 51 | 9'46220 | 42 | 9'48126 | 45 | 10'51874 | 9'98094 | 9 |
| 52 | 9'46262 | 41 | 9'48171 | 46 | 10'51829 | 9'98090 | 8 |
| 53 | 9'46303 | 42 | 9'48217 | 45 | 10'51783 | 9'98087 | 7 |
| 54 | 9'46345 | 41 | 9'48262 | 45 | 10'51738 | 9'98083 | 6 |
| 55 | 9'46386 | 42 | 9'48307 | 46 | 10'51693 | 9'98079 | 5 |
| 56 | 9'46428 | 41 | 9'48353 | 45 | 10'51647 | 9'98075 | 4 |
| 57 | 9'46469 | 42 | 9'48398 | 45 | 10'51602 | 9'98071 | 3 |
| 58 | 9'46511 | 41 | 9'48443 | 46 | 10'51557 | 9'98067 | 2 |
| 59 | 9'46552 | 42 | 9'48489 | 45 | 10'51511 | 9'98063 | 1 |
| 60 | 9'46594 | 42 | 9'48534 | 45 | 10'51466 | 9'98060 | 0 |

[73 degrees.]

[17 degrees.]

| ' | Sine. | Diff. | Tangent. | Diff. | Cotang. | Cosine. | D. | ' |
|----|----------|-------|----------|----------|----------|---------|----|----|
| 0 | 9°46'594 | 41 | 9°48'534 | 45 | 10°51466 | 9°80600 | 4 | 60 |
| 1 | 9°46'615 | 41 | 9°48'579 | 45 | 10°51421 | 9°80556 | 4 | 59 |
| 2 | 9°46'676 | 41 | 9°48'624 | 45 | 10°51376 | 9°80512 | 4 | 58 |
| 3 | 9°46'717 | 41 | 9°48'669 | 45 | 10°51331 | 9°80468 | 4 | 57 |
| 4 | 9°46'758 | 41 | 9°48'714 | 45 | 10°51286 | 9°80424 | 4 | 56 |
| 5 | 9°46'800 | 42 | 9°48'759 | 45 | 10°51241 | 9°80380 | 4 | 55 |
| 6 | 9°46'841 | 41 | 9°48'804 | 45 | 10°51196 | 9°80336 | 4 | 54 |
| 7 | 9°46'882 | 41 | 9°48'849 | 45 | 10°51151 | 9°80292 | 3 | 53 |
| 8 | 9°46'923 | 41 | 9°48'894 | 45 | 10°51106 | 9°80248 | 3 | 52 |
| 9 | 9°46'964 | 41 | 9°48'939 | 45 | 10°51061 | 9°80204 | 4 | 51 |
| 10 | 9°47'005 | 40 | 9°48'984 | 45 | 10°51016 | 9°80160 | 4 | 50 |
| 11 | 9°47'045 | 41 | 9°49'029 | 45 | 10°50971 | 9°80116 | 4 | 49 |
| 12 | 9°47'086 | 41 | 9°49'073 | 44 | 10°50927 | 9°80072 | 4 | 48 |
| 13 | 9°47'127 | 41 | 9°49'118 | 45 | 10°50882 | 9°80028 | 4 | 47 |
| 14 | 9°47'168 | 41 | 9°49'163 | 45 | 10°50837 | 9°80005 | 4 | 46 |
| 15 | 9°47'209 | 40 | 9°49'207 | 44 | 10°50793 | 9°80001 | 4 | 45 |
| 16 | 9°47'249 | 41 | 9°49'252 | 45 | 10°50748 | 9°79997 | 4 | 44 |
| 17 | 9°47'290 | 40 | 9°49'296 | 44 | 10°50704 | 9°79993 | 4 | 43 |
| 18 | 9°47'330 | 41 | 9°49'341 | 45 | 10°50659 | 9°79989 | 3 | 42 |
| 19 | 9°47'371 | 40 | 9°49'385 | 45 | 10°50615 | 9°79986 | 4 | 41 |
| 20 | 9°47'411 | 41 | 9°49'429 | 45 | 10°50570 | 9°79982 | 4 | 40 |
| 21 | 9°47'452 | 40 | 9°49'474 | 44 | 10°50526 | 9°79978 | 4 | 39 |
| 22 | 9°47'492 | 41 | 9°49'519 | 45 | 10°50481 | 9°79974 | 4 | 38 |
| 23 | 9°47'533 | 40 | 9°49'563 | 44 | 10°50437 | 9°79970 | 4 | 37 |
| 24 | 9°47'573 | 40 | 9°49'607 | 45 | 10°50393 | 9°79966 | 4 | 36 |
| 25 | 9°47'613 | 41 | 9°49'652 | 44 | 10°50348 | 9°79962 | 4 | 35 |
| 26 | 9°47'654 | 40 | 9°49'696 | 44 | 10°50304 | 9°79958 | 4 | 34 |
| 27 | 9°47'694 | 40 | 9°49'740 | 44 | 10°50260 | 9°79954 | 4 | 33 |
| 28 | 9°47'734 | 40 | 9°49'784 | 44 | 10°50216 | 9°79950 | 4 | 32 |
| 29 | 9°47'774 | 40 | 9°49'828 | 44 | 10°50172 | 9°79946 | 4 | 31 |
| 30 | 9°47'814 | 40 | 9°49'872 | 44 | 10°50128 | 9°79942 | 4 | 30 |
| ' | Cosine. | | Cotang. | Tangent. | Sine. | | | ' |

[72 degrees.]

[17 degrees.]

| ' | Sine. | Diff. | Tangent. | Diff. | Cotang. | Cosine. | D. | ' |
|----|----------|-------|----------|-------|----------|---------|----|----|
| 30 | 9°47'814 | 40 | 9°49'872 | 44 | 10°50128 | 9°79942 | 4 | 30 |
| 31 | 9°47'854 | 40 | 9°49'916 | 44 | 10°50084 | 9°79938 | 4 | 29 |
| 32 | 9°47'894 | 40 | 9°49'960 | 44 | 10°50040 | 9°79934 | 4 | 28 |
| 33 | 9°47'934 | 40 | 9°50'004 | 44 | 10°49996 | 9°79930 | 4 | 27 |
| 34 | 9°47'974 | 40 | 9°50'048 | 44 | 10°49952 | 9°79926 | 4 | 26 |
| 35 | 9°48'014 | 40 | 9°50'092 | 44 | 10°49908 | 9°79922 | 4 | 25 |
| 36 | 9°48'054 | 40 | 9°50'136 | 44 | 10°49864 | 9°79918 | 4 | 24 |
| 37 | 9°48'094 | 39 | 9°50'180 | 43 | 10°49820 | 9°79914 | 4 | 23 |
| 38 | 9°48'133 | 40 | 9°50'224 | 44 | 10°49777 | 9°79910 | 4 | 22 |
| 39 | 9°48'173 | 40 | 9°50'268 | 44 | 10°49733 | 9°79906 | 4 | 21 |
| 40 | 9°48'213 | 39 | 9°50'312 | 43 | 10°49689 | 9°79902 | 4 | 20 |
| 41 | 9°48'252 | 40 | 9°50'355 | 43 | 10°49645 | 9°79898 | 4 | 19 |
| 42 | 9°48'292 | 40 | 9°50'398 | 44 | 10°49602 | 9°79894 | 4 | 18 |
| 43 | 9°48'332 | 39 | 9°50'442 | 43 | 10°49558 | 9°79890 | 4 | 17 |
| 44 | 9°48'371 | 40 | 9°50'485 | 44 | 10°49515 | 9°79886 | 4 | 16 |
| 45 | 9°48'411 | 39 | 9°50'529 | 43 | 10°49471 | 9°79882 | 4 | 15 |
| 46 | 9°48'450 | 40 | 9°50'572 | 44 | 10°49428 | 9°79878 | 4 | 14 |
| 47 | 9°48'490 | 39 | 9°50'616 | 43 | 10°49384 | 9°79874 | 4 | 13 |
| 48 | 9°48'529 | 39 | 9°50'659 | 44 | 10°49341 | 9°79870 | 4 | 12 |
| 49 | 9°48'568 | 39 | 9°50'703 | 43 | 10°49297 | 9°79866 | 5 | 11 |
| 50 | 9°48'607 | 40 | 9°50'746 | 43 | 10°49254 | 9°79861 | 5 | 10 |
| 51 | 9°48'647 | 39 | 9°50'789 | 44 | 10°49211 | 9°79857 | 4 | 9 |
| 52 | 9°48'686 | 39 | 9°50'833 | 43 | 10°49167 | 9°79853 | 4 | 8 |
| 53 | 9°48'725 | 39 | 9°50'876 | 43 | 10°49124 | 9°79849 | 4 | 7 |
| 54 | 9°48'764 | 39 | 9°50'919 | 43 | 10°49081 | 9°79845 | 4 | 6 |
| 55 | 9°48'803 | 39 | 9°50'962 | 43 | 10°49038 | 9°79841 | 4 | 5 |
| 56 | 9°48'842 | 39 | 9°51'005 | 43 | 10°48995 | 9°79837 | 4 | 4 |
| 57 | 9°48'881 | 39 | 9°51'048 | 44 | 10°48952 | 9°79833 | 4 | 3 |
| 58 | 9°48'920 | 39 | 9°51'092 | 43 | 10°48908 | 9°79829 | 4 | 2 |
| 59 | 9°48'959 | 39 | 9°51'135 | 43 | 10°48865 | 9°79825 | 4 | 1 |
| 60 | 9°48'998 | 39 | 9°51'178 | 43 | 10°48822 | 9°79821 | 4 | 0 |
| ' | Cosine. | | Cotang. | | Tangent. | Sine. | | ' |

[72 degrees.]

[18 degrees.]

| ' | Sine. | Diff. | Tangent. | Diff. | Cotang. | Diff. | Cotang. | Cosine. | D. | ' |
|----|---------|-------|----------|-------|----------|-------|---------|---------|----|---|
| 30 | 9°50148 | 37 | 9°52452 | 42 | 10°47548 | 42 | 9°97696 | 5 | 30 | |
| 31 | 9°50185 | 38 | 9°52494 | 42 | 10°47506 | 42 | 9°97691 | 4 | 29 | |
| 32 | 9°50223 | 38 | 9°52536 | 42 | 10°47464 | 42 | 9°97687 | 4 | 28 | |
| 33 | 9°50261 | 37 | 9°52578 | 42 | 10°47422 | 42 | 9°97683 | 4 | 27 | |
| 34 | 9°50298 | 38 | 9°52620 | 41 | 10°47380 | 41 | 9°97679 | 5 | 26 | |
| 35 | 9°50336 | 38 | 9°52661 | 42 | 10°47339 | 42 | 9°97674 | 4 | 25 | |
| 36 | 9°50374 | 37 | 9°52703 | 42 | 10°47297 | 42 | 9°97670 | 4 | 24 | |
| 37 | 9°50411 | 38 | 9°52745 | 42 | 10°47255 | 42 | 9°97666 | 4 | 23 | |
| 38 | 9°50449 | 37 | 9°52787 | 42 | 10°47213 | 42 | 9°97662 | 4 | 22 | |
| 39 | 9°50486 | 37 | 9°52829 | 41 | 10°47171 | 41 | 9°97657 | 4 | 21 | |
| 40 | 9°50523 | 38 | 9°52870 | 42 | 10°47130 | 42 | 9°97653 | 4 | 20 | |
| 41 | 9°50561 | 37 | 9°52912 | 41 | 10°47088 | 41 | 9°97649 | 4 | 19 | |
| 42 | 9°50598 | 37 | 9°52953 | 42 | 10°47047 | 42 | 9°97645 | 5 | 18 | |
| 43 | 9°50635 | 38 | 9°52995 | 42 | 10°47005 | 42 | 9°97640 | 4 | 17 | |
| 44 | 9°50673 | 37 | 9°53037 | 41 | 10°46963 | 41 | 9°97636 | 4 | 16 | |
| 45 | 9°50710 | 37 | 9°53078 | 42 | 10°46922 | 42 | 9°97632 | 4 | 15 | |
| 46 | 9°50747 | 37 | 9°53120 | 41 | 10°46880 | 41 | 9°97628 | 4 | 14 | |
| 47 | 9°50784 | 37 | 9°53161 | 41 | 10°46839 | 41 | 9°97623 | 4 | 13 | |
| 48 | 9°50821 | 37 | 9°53202 | 42 | 10°46798 | 42 | 9°97619 | 4 | 12 | |
| 49 | 9°50858 | 38 | 9°53244 | 41 | 10°46756 | 41 | 9°97615 | 5 | 11 | |
| 50 | 9°50896 | 37 | 9°53285 | 42 | 10°46715 | 42 | 9°97610 | 4 | 10 | |
| 51 | 9°50933 | 37 | 9°53327 | 41 | 10°46673 | 41 | 9°97606 | 4 | 9 | |
| 52 | 9°50970 | 37 | 9°53368 | 41 | 10°46632 | 41 | 9°97602 | 4 | 8 | |
| 53 | 9°51007 | 36 | 9°53409 | 41 | 10°46591 | 41 | 9°97597 | 5 | 7 | |
| 54 | 9°51043 | 37 | 9°53450 | 42 | 10°46550 | 42 | 9°97593 | 4 | 6 | |
| 55 | 9°51080 | 37 | 9°53492 | 41 | 10°46508 | 41 | 9°97589 | 5 | 5 | |
| 56 | 9°51117 | 37 | 9°53533 | 41 | 10°46467 | 41 | 9°97584 | 4 | 4 | |
| 57 | 9°51154 | 37 | 9°53574 | 41 | 10°46426 | 41 | 9°97580 | 4 | 3 | |
| 58 | 9°51191 | 36 | 9°53615 | 41 | 10°46385 | 41 | 9°97576 | 5 | 2 | |
| 59 | 9°51227 | 37 | 9°53656 | 41 | 10°46344 | 41 | 9°97571 | 4 | 1 | |
| 60 | 9°51264 | 37 | 9°53697 | 41 | 10°46303 | 41 | 9°97567 | 4 | 0 | |
| ' | Cosine. | | Cotang. | | Tangent. | | Sine. | | | ' |

[71 degrees.]

[18 degrees.]

| ' | Sine. | Diff. | Tangent. | Diff. | Cotang. | Cosine. | D. | ' |
|----|---------|-------|----------|-------|----------|---------|----|----|
| 0 | 9°48998 | 39 | 9°51178 | 43 | 10°48822 | 9°97821 | 4 | 60 |
| 1 | 9°49037 | 39 | 9°51221 | 43 | 10°48779 | 9°97817 | 4 | 59 |
| 2 | 9°49076 | 39 | 9°51264 | 43 | 10°48736 | 9°97812 | 5 | 58 |
| 3 | 9°49115 | 38 | 9°51306 | 42 | 10°48694 | 9°97808 | 4 | 57 |
| 4 | 9°49153 | 38 | 9°51349 | 43 | 10°48651 | 9°97804 | 4 | 56 |
| 5 | 9°49192 | 39 | 9°51392 | 43 | 10°48608 | 9°97800 | 4 | 55 |
| 6 | 9°49231 | 38 | 9°51435 | 43 | 10°48565 | 9°97796 | 4 | 54 |
| 7 | 9°49269 | 39 | 9°51478 | 43 | 10°48522 | 9°97792 | 4 | 53 |
| 8 | 9°49308 | 39 | 9°51520 | 42 | 10°48480 | 9°97788 | 4 | 52 |
| 9 | 9°49347 | 38 | 9°51563 | 43 | 10°48437 | 9°97784 | 4 | 51 |
| 10 | 9°49385 | 39 | 9°51606 | 42 | 10°48394 | 9°97779 | 5 | 50 |
| 11 | 9°49424 | 38 | 9°51648 | 43 | 10°48352 | 9°97775 | 4 | 49 |
| 12 | 9°49462 | 38 | 9°51691 | 43 | 10°48309 | 9°97771 | 4 | 48 |
| 13 | 9°49500 | 39 | 9°51734 | 42 | 10°48266 | 9°97767 | 4 | 47 |
| 14 | 9°49539 | 38 | 9°51776 | 43 | 10°48224 | 9°97763 | 4 | 46 |
| 15 | 9°49577 | 38 | 9°51819 | 42 | 10°48181 | 9°97759 | 5 | 45 |
| 16 | 9°49615 | 39 | 9°51861 | 42 | 10°48139 | 9°97754 | 4 | 44 |
| 17 | 9°49654 | 38 | 9°51903 | 43 | 10°48097 | 9°97750 | 4 | 43 |
| 18 | 9°49692 | 38 | 9°51946 | 42 | 10°48054 | 9°97746 | 4 | 42 |
| 19 | 9°49730 | 38 | 9°51988 | 43 | 10°48012 | 9°97742 | 4 | 41 |
| 20 | 9°49768 | 38 | 9°52031 | 42 | 10°47969 | 9°97738 | 4 | 40 |
| 21 | 9°49806 | 38 | 9°52073 | 42 | 10°47927 | 9°97734 | 4 | 39 |
| 22 | 9°49844 | 38 | 9°52115 | 42 | 10°47885 | 9°97729 | 5 | 38 |
| 23 | 9°49882 | 38 | 9°52157 | 43 | 10°47843 | 9°97725 | 4 | 37 |
| 24 | 9°49920 | 38 | 9°52200 | 42 | 10°47800 | 9°97721 | 4 | 36 |
| 25 | 9°49958 | 38 | 9°52242 | 42 | 10°47758 | 9°97717 | 4 | 35 |
| 26 | 9°49996 | 38 | 9°52284 | 42 | 10°47716 | 9°97713 | 4 | 34 |
| 27 | 9°50034 | 38 | 9°52326 | 42 | 10°47674 | 9°97708 | 5 | 33 |
| 28 | 9°50072 | 38 | 9°52368 | 42 | 10°47632 | 9°97704 | 4 | 32 |
| 29 | 9°50110 | 38 | 9°52410 | 42 | 10°47590 | 9°97700 | 4 | 31 |
| 30 | 9°50148 | 38 | 9°52452 | 42 | 10°47548 | 9°97696 | 4 | 30 |
| ' | Cosine. | | Cotang. | | Tangent. | Sine. | | ' |

[71 degrees.]

[19 degrees.]

| ' | Sine. | Diff. | Tangent. | Diff. | Cotang. | Cosine. | D. | ' |
|----|---------|-------|----------|-------|----------|---------|----|----|
| 30 | 9°52350 | 35 | 9°54915 | 40 | 10°45085 | 9°97435 | 5 | 30 |
| 31 | 9°52385 | 36 | 9°54955 | 40 | 10°45045 | 9°97430 | 4 | 29 |
| 32 | 9°52421 | 35 | 9°54995 | 40 | 10°45005 | 9°97426 | 4 | 28 |
| 33 | 9°52456 | 35 | 9°55035 | 40 | 10°44965 | 9°97421 | 5 | 27 |
| 34 | 9°52492 | 35 | 9°55075 | 40 | 10°44925 | 9°97417 | 4 | 26 |
| 35 | 9°52527 | 36 | 9°55115 | 40 | 10°44885 | 9°97412 | 5 | 25 |
| 36 | 9°52563 | 35 | 9°55155 | 40 | 10°44845 | 9°97408 | 4 | 24 |
| 37 | 9°52598 | 36 | 9°55195 | 40 | 10°44805 | 9°97403 | 5 | 23 |
| 38 | 9°52634 | 35 | 9°55235 | 40 | 10°44765 | 9°97399 | 4 | 22 |
| 39 | 9°52669 | 36 | 9°55275 | 40 | 10°44725 | 9°97394 | 5 | 21 |
| 40 | 9°52705 | 35 | 9°55315 | 40 | 10°44685 | 9°97390 | 4 | 20 |
| 41 | 9°52740 | 35 | 9°55355 | 40 | 10°44645 | 9°97385 | 5 | 19 |
| 42 | 9°52775 | 36 | 9°55395 | 39 | 10°44605 | 9°97381 | 4 | 18 |
| 43 | 9°52811 | 35 | 9°55434 | 40 | 10°44566 | 9°97376 | 5 | 17 |
| 44 | 9°52846 | 35 | 9°55474 | 40 | 10°44526 | 9°97372 | 5 | 16 |
| 45 | 9°52881 | 35 | 9°55514 | 40 | 10°44486 | 9°97367 | 4 | 15 |
| 46 | 9°52916 | 35 | 9°55554 | 39 | 10°44446 | 9°97363 | 5 | 14 |
| 47 | 9°52951 | 35 | 9°55593 | 40 | 10°44407 | 9°97358 | 5 | 13 |
| 48 | 9°52986 | 35 | 9°55633 | 40 | 10°44367 | 9°97353 | 4 | 12 |
| 49 | 9°53021 | 35 | 9°55673 | 39 | 10°44327 | 9°97349 | 5 | 11 |
| 50 | 9°53056 | 36 | 9°55712 | 40 | 10°44288 | 9°97344 | 5 | 10 |
| 51 | 9°53092 | 34 | 9°55752 | 40 | 10°44248 | 9°97340 | 4 | 9 |
| 52 | 9°53126 | 35 | 9°55791 | 40 | 10°44209 | 9°97335 | 5 | 8 |
| 53 | 9°53161 | 35 | 9°55831 | 39 | 10°44169 | 9°97331 | 4 | 7 |
| 54 | 9°53196 | 35 | 9°55870 | 40 | 10°44130 | 9°97326 | 5 | 6 |
| 55 | 9°53231 | 35 | 9°55910 | 39 | 10°44090 | 9°97322 | 4 | 5 |
| 56 | 9°53266 | 35 | 9°55949 | 40 | 10°44051 | 9°97317 | 5 | 4 |
| 57 | 9°53301 | 35 | 9°55989 | 40 | 10°44011 | 9°97312 | 5 | 3 |
| 58 | 9°53336 | 34 | 9°56028 | 39 | 10°43972 | 9°97308 | 4 | 2 |
| 59 | 9°53370 | 35 | 9°56067 | 40 | 10°43933 | 9°97303 | 5 | 1 |
| 60 | 9°53405 | 35 | 9°56107 | 40 | 10°43893 | 9°97299 | 4 | 0 |
| ' | Cosine. | | Cotang. | | Tangent. | Sine. | | ' |

[70 degrees.]

[19 degrees.]

| ' | Sine. | Diff. | Tangent. | Diff. | Cotang. | Cosine. | D. | ' |
|----|---------|-------|----------|-------|----------|---------|----|----|
| 0 | 9°51264 | 37 | 9°53097 | 41 | 10°46303 | 9°97567 | 4 | 60 |
| 1 | 9°51301 | 37 | 9°53138 | 41 | 10°46262 | 9°97563 | 4 | 59 |
| 2 | 9°51338 | 36 | 9°53179 | 41 | 10°46221 | 9°97558 | 5 | 58 |
| 3 | 9°51374 | 36 | 9°53220 | 41 | 10°46180 | 9°97554 | 4 | 57 |
| 4 | 9°51411 | 36 | 9°53261 | 41 | 10°46139 | 9°97550 | 5 | 56 |
| 5 | 9°51447 | 37 | 9°53302 | 41 | 10°46098 | 9°97545 | 5 | 55 |
| 6 | 9°51484 | 37 | 9°53343 | 41 | 10°46057 | 9°97541 | 4 | 54 |
| 7 | 9°51520 | 36 | 9°53384 | 41 | 10°46016 | 9°97536 | 5 | 53 |
| 8 | 9°51557 | 36 | 9°53425 | 40 | 10°45975 | 9°97532 | 4 | 52 |
| 9 | 9°51593 | 36 | 9°53465 | 41 | 10°45935 | 9°97528 | 5 | 51 |
| 10 | 9°51629 | 37 | 9°53506 | 41 | 10°45894 | 9°97523 | 4 | 50 |
| 11 | 9°51666 | 36 | 9°53547 | 40 | 10°45853 | 9°97519 | 4 | 49 |
| 12 | 9°51702 | 36 | 9°53587 | 41 | 10°45813 | 9°97515 | 5 | 48 |
| 13 | 9°51738 | 36 | 9°53628 | 41 | 10°45772 | 9°97510 | 4 | 47 |
| 14 | 9°51774 | 37 | 9°53669 | 40 | 10°45731 | 9°97506 | 4 | 46 |
| 15 | 9°51811 | 36 | 9°53709 | 41 | 10°45691 | 9°97501 | 4 | 45 |
| 16 | 9°51847 | 36 | 9°53750 | 40 | 10°45650 | 9°97497 | 5 | 44 |
| 17 | 9°51883 | 36 | 9°53790 | 41 | 10°45610 | 9°97492 | 4 | 43 |
| 18 | 9°51919 | 36 | 9°53831 | 40 | 10°45569 | 9°97488 | 4 | 42 |
| 19 | 9°51955 | 36 | 9°53871 | 41 | 10°45529 | 9°97484 | 5 | 41 |
| 20 | 9°51991 | 36 | 9°53912 | 40 | 10°45488 | 9°97479 | 4 | 40 |
| 21 | 9°52027 | 36 | 9°53952 | 41 | 10°45448 | 9°97475 | 5 | 39 |
| 22 | 9°52063 | 36 | 9°53993 | 40 | 10°45407 | 9°97470 | 4 | 38 |
| 23 | 9°52099 | 36 | 9°54033 | 40 | 10°45367 | 9°97466 | 5 | 37 |
| 24 | 9°52135 | 36 | 9°54073 | 41 | 10°45327 | 9°97461 | 4 | 36 |
| 25 | 9°52171 | 36 | 9°54114 | 40 | 10°45286 | 9°97457 | 4 | 35 |
| 26 | 9°52207 | 35 | 9°54154 | 40 | 10°45246 | 9°97453 | 5 | 34 |
| 27 | 9°52242 | 36 | 9°54194 | 41 | 10°45206 | 9°97448 | 4 | 33 |
| 28 | 9°52278 | 36 | 9°54235 | 40 | 10°45165 | 9°97444 | 5 | 32 |
| 29 | 9°52314 | 36 | 9°54275 | 40 | 10°45125 | 9°97439 | 4 | 31 |
| 30 | 9°52350 | 36 | 9°54315 | 40 | 10°45085 | 9°97435 | 4 | 30 |
| ' | Cosine. | | Cotang. | | Tangent. | Sine. | | ' |

[70 degrees.]

[20 degrees.]

| ' | Sine. | Diff. | Tangent. | Diff. | Cotang. | Cosine. | D. | ' |
|----|---------|-------|----------|-------|----------|---------|----|----|
| 30 | 9'54433 | 33 | 9'57274 | 38 | 10'42726 | 9'97159 | 5 | 30 |
| 31 | 9'54466 | 34 | 9'57312 | 39 | 10'42688 | 9'97154 | 5 | 29 |
| 32 | 9'54500 | 34 | 9'57351 | 38 | 10'42649 | 9'97149 | 5 | 28 |
| 33 | 9'54534 | 33 | 9'57389 | 39 | 10'42611 | 9'97145 | 4 | 27 |
| 34 | 9'54567 | 34 | 9'57428 | 38 | 10'42572 | 9'97140 | 5 | 26 |
| 35 | 9'54601 | 34 | 9'57466 | 38 | 10'42534 | 9'97135 | 5 | 25 |
| 36 | 9'54635 | 33 | 9'57504 | 39 | 10'42496 | 9'97130 | 5 | 24 |
| 37 | 9'54668 | 34 | 9'57543 | 38 | 10'42457 | 9'97126 | 4 | 23 |
| 38 | 9'54702 | 33 | 9'57581 | 38 | 10'42419 | 9'97121 | 5 | 22 |
| 39 | 9'54735 | 34 | 9'57619 | 39 | 10'42381 | 9'97116 | 5 | 21 |
| 40 | 9'54769 | 33 | 9'57658 | 38 | 10'42342 | 9'97111 | 4 | 19 |
| 41 | 9'54802 | 34 | 9'57696 | 38 | 10'42304 | 9'97107 | 5 | 18 |
| 42 | 9'54836 | 33 | 9'57734 | 39 | 10'42266 | 9'97102 | 5 | 17 |
| 43 | 9'54869 | 34 | 9'57772 | 38 | 10'42228 | 9'97097 | 5 | 16 |
| 44 | 9'54903 | 33 | 9'57810 | 39 | 10'42190 | 9'97092 | 5 | 15 |
| 45 | 9'54936 | 33 | 9'57849 | 38 | 10'42151 | 9'97087 | 4 | 14 |
| 46 | 9'54969 | 34 | 9'57887 | 38 | 10'42113 | 9'97083 | 5 | 13 |
| 47 | 9'55003 | 33 | 9'57925 | 38 | 10'42075 | 9'97078 | 5 | 12 |
| 48 | 9'55036 | 33 | 9'57963 | 38 | 10'42037 | 9'97073 | 5 | 11 |
| 49 | 9'55069 | 33 | 9'58001 | 38 | 10'41999 | 9'97068 | 5 | 10 |
| 50 | 9'55102 | 34 | 9'58039 | 38 | 10'41961 | 9'97063 | 4 | 9 |
| 51 | 9'55136 | 33 | 9'58077 | 38 | 10'41923 | 9'97059 | 5 | 8 |
| 52 | 9'55169 | 33 | 9'58115 | 38 | 10'41885 | 9'97054 | 5 | 7 |
| 53 | 9'55202 | 33 | 9'58153 | 38 | 10'41847 | 9'97049 | 5 | 6 |
| 54 | 9'55235 | 33 | 9'58191 | 38 | 10'41809 | 9'97044 | 5 | 5 |
| 55 | 9'55268 | 33 | 9'58229 | 38 | 10'41771 | 9'97039 | 4 | 4 |
| 56 | 9'55301 | 33 | 9'58267 | 37 | 10'41733 | 9'97035 | 5 | 3 |
| 57 | 9'55334 | 33 | 9'58304 | 38 | 10'41696 | 9'97030 | 5 | 2 |
| 58 | 9'55367 | 33 | 9'58342 | 38 | 10'41658 | 9'97025 | 5 | 1 |
| 59 | 9'55400 | 33 | 9'58380 | 38 | 10'41620 | 9'97020 | 5 | 0 |
| 60 | 9'55433 | | 9'58418 | | 10'41582 | 9'97015 | | |
| ' | Cosine. | | Cotang. | | Tangent. | Sine. | | ' |

[69 degrees.]

[20 degrees.]

| ' | Sine. | Diff. | Tangent. | Diff. | Cotang. | Cosine. | D. | ' |
|----|---------|-------|----------|-------|----------|---------|----|----|
| 0 | 9'53405 | 35 | 9'56107 | 39 | 10'43803 | 9'97299 | 5 | 60 |
| 1 | 9'53440 | 35 | 9'56146 | 39 | 10'43854 | 9'97294 | 5 | 59 |
| 2 | 9'53475 | 34 | 9'56185 | 39 | 10'43815 | 9'97289 | 5 | 58 |
| 3 | 9'53509 | 34 | 9'56224 | 40 | 10'43776 | 9'97285 | 4 | 57 |
| 4 | 9'53544 | 34 | 9'56264 | 39 | 10'43736 | 9'97280 | 5 | 56 |
| 5 | 9'53578 | 35 | 9'56303 | 39 | 10'43697 | 9'97276 | 4 | 55 |
| 6 | 9'53613 | 34 | 9'56342 | 39 | 10'43658 | 9'97271 | 5 | 54 |
| 7 | 9'53647 | 35 | 9'56381 | 39 | 10'43619 | 9'97266 | 4 | 53 |
| 8 | 9'53682 | 34 | 9'56420 | 39 | 10'43580 | 9'97262 | 5 | 52 |
| 9 | 9'53716 | 34 | 9'56459 | 39 | 10'43541 | 9'97257 | 5 | 51 |
| 10 | 9'53751 | 35 | 9'56498 | 38 | 10'43502 | 9'97252 | 5 | 50 |
| 11 | 9'53785 | 34 | 9'56537 | 39 | 10'43463 | 9'97248 | 4 | 49 |
| 12 | 9'53819 | 35 | 9'56576 | 39 | 10'43424 | 9'97243 | 5 | 48 |
| 13 | 9'53854 | 34 | 9'56615 | 39 | 10'43385 | 9'97238 | 5 | 47 |
| 14 | 9'53888 | 34 | 9'56654 | 39 | 10'43346 | 9'97234 | 4 | 46 |
| 15 | 9'53922 | 35 | 9'56693 | 39 | 10'43307 | 9'97229 | 5 | 45 |
| 16 | 9'53957 | 34 | 9'56732 | 39 | 10'43268 | 9'97224 | 4 | 44 |
| 17 | 9'53991 | 34 | 9'56771 | 39 | 10'43229 | 9'97220 | 5 | 43 |
| 18 | 9'54025 | 34 | 9'56810 | 38 | 10'43190 | 9'97215 | 5 | 42 |
| 19 | 9'54059 | 34 | 9'56849 | 39 | 10'43151 | 9'97210 | 5 | 41 |
| 20 | 9'54093 | 34 | 9'56887 | 39 | 10'43113 | 9'97206 | 4 | 40 |
| 21 | 9'54127 | 34 | 9'56926 | 39 | 10'43074 | 9'97201 | 5 | 39 |
| 22 | 9'54161 | 34 | 9'56965 | 39 | 10'43035 | 9'97196 | 5 | 38 |
| 23 | 9'54195 | 34 | 9'57004 | 38 | 10'42996 | 9'97192 | 4 | 37 |
| 24 | 9'54229 | 34 | 9'57042 | 39 | 10'42958 | 9'97187 | 5 | 36 |
| 25 | 9'54263 | 34 | 9'57081 | 39 | 10'42919 | 9'97182 | 4 | 35 |
| 26 | 9'54297 | 34 | 9'57120 | 38 | 10'42880 | 9'97178 | 4 | 34 |
| 27 | 9'54331 | 34 | 9'57158 | 38 | 10'42842 | 9'97173 | 5 | 33 |
| 28 | 9'54365 | 34 | 9'57197 | 38 | 10'42803 | 9'97168 | 5 | 32 |
| 29 | 9'54399 | 34 | 9'57235 | 39 | 10'42765 | 9'97163 | 4 | 31 |
| 30 | 9'54433 | | 9'57274 | | 10'42726 | 9'97159 | | 30 |
| ' | Cosine. | | Cotang. | | Tangent. | Sine. | | ' |

[69 degrees.]

[21 degrees.]

| ' | Sine. | Diff. | Tangent. | Diff. | Cotang. | Cosine. | ' |
|----|---------|-------|----------|-------|----------|---------|----|
| 0 | 9°55433 | 33 | 9°58418 | 37 | 10°41582 | 9°97015 | 60 |
| 1 | 9°55466 | 33 | 9°58455 | 38 | 10°41545 | 9°97010 | 59 |
| 2 | 9°55499 | 33 | 9°58493 | 38 | 10°41507 | 9°97005 | 58 |
| 3 | 9°55532 | 32 | 9°58531 | 38 | 10°41469 | 9°97001 | 4 |
| 4 | 9°55564 | 33 | 9°58569 | 37 | 10°41431 | 9°96996 | 5 |
| 5 | 9°55597 | 33 | 9°58606 | 38 | 10°41394 | 9°96991 | 55 |
| 6 | 9°55630 | 33 | 9°58644 | 38 | 10°41356 | 9°96986 | 54 |
| 7 | 9°55663 | 32 | 9°58681 | 37 | 10°41319 | 9°96981 | 53 |
| 8 | 9°55695 | 33 | 9°58719 | 38 | 10°41281 | 9°96976 | 52 |
| 9 | 9°55728 | 33 | 9°58757 | 37 | 10°41243 | 9°96971 | 51 |
| 10 | 9°55761 | 32 | 9°58794 | 38 | 10°41206 | 9°96966 | 50 |
| 11 | 9°55793 | 33 | 9°58832 | 37 | 10°41168 | 9°96962 | 49 |
| 12 | 9°55826 | 32 | 9°58869 | 38 | 10°41131 | 9°96957 | 48 |
| 13 | 9°55858 | 33 | 9°58907 | 37 | 10°41093 | 9°96952 | 47 |
| 14 | 9°55891 | 32 | 9°58944 | 37 | 10°41056 | 9°96947 | 46 |
| 15 | 9°55923 | 33 | 9°58981 | 38 | 10°41019 | 9°96942 | 45 |
| 16 | 9°55956 | 32 | 9°59019 | 37 | 10°40981 | 9°96937 | 44 |
| 17 | 9°55988 | 33 | 9°59056 | 38 | 10°40944 | 9°96932 | 43 |
| 18 | 9°56021 | 32 | 9°59094 | 37 | 10°40906 | 9°96927 | 42 |
| 19 | 9°56053 | 32 | 9°59131 | 37 | 10°40869 | 9°96922 | 41 |
| 20 | 9°56085 | 33 | 9°59168 | 37 | 10°40832 | 9°96917 | 40 |
| 21 | 9°56118 | 32 | 9°59205 | 38 | 10°40795 | 9°96912 | 39 |
| 22 | 9°56150 | 32 | 9°59243 | 37 | 10°40757 | 9°96907 | 38 |
| 23 | 9°56182 | 33 | 9°59280 | 37 | 10°40720 | 9°96903 | 37 |
| 24 | 9°56215 | 32 | 9°59317 | 37 | 10°40683 | 9°96898 | 36 |
| 25 | 9°56247 | 32 | 9°59354 | 37 | 10°40646 | 9°96893 | 35 |
| 26 | 9°56279 | 32 | 9°59391 | 38 | 10°40609 | 9°96888 | 34 |
| 27 | 9°56311 | 32 | 9°59429 | 37 | 10°40571 | 9°96883 | 33 |
| 28 | 9°56343 | 32 | 9°59466 | 37 | 10°40534 | 9°96878 | 32 |
| 29 | 9°56375 | 33 | 9°59503 | 37 | 10°40497 | 9°96873 | 31 |
| 30 | 9°56408 | | 9°59540 | | 10°40460 | 9°96868 | 30 |
| ' | Cosine. | | Cotang. | | Tangent. | Sine. | ' |

[68 degrees.]

[21 degrees.]

| ' | Sine. | Diff. | Tangent. | Diff. | Cotang. | Cosine. | ' |
|----|---------|-------|----------|-------|----------|---------|----|
| 30 | 9°56440 | 32 | 9°59577 | 37 | 10°40423 | 9°96863 | 30 |
| 31 | 9°56472 | 32 | 9°59614 | 37 | 10°40386 | 9°96858 | 29 |
| 32 | 9°56504 | 32 | 9°59651 | 37 | 10°40349 | 9°96853 | 28 |
| 33 | 9°56536 | 31 | 9°59688 | 37 | 10°40312 | 9°96848 | 27 |
| 34 | 9°56568 | 32 | 9°59725 | 37 | 10°40275 | 9°96843 | 26 |
| 35 | 9°56599 | 31 | 9°59762 | 37 | 10°40238 | 9°96838 | 25 |
| 36 | 9°56631 | 32 | 9°59799 | 36 | 10°40201 | 9°96833 | 24 |
| 37 | 9°56663 | 32 | 9°59836 | 37 | 10°40165 | 9°96828 | 23 |
| 38 | 9°56695 | 32 | 9°59872 | 37 | 10°40128 | 9°96823 | 22 |
| 39 | 9°56727 | 32 | 9°59909 | 37 | 10°40091 | 9°96818 | 21 |
| 40 | 9°56759 | 31 | 9°59946 | 37 | 10°40054 | 9°96813 | 20 |
| 41 | 9°56790 | 32 | 9°59983 | 36 | 10°40017 | 9°96808 | 19 |
| 42 | 9°56822 | 32 | 9°60019 | 37 | 10°39981 | 9°96803 | 18 |
| 43 | 9°56854 | 32 | 9°60056 | 37 | 10°39944 | 9°96798 | 17 |
| 44 | 9°56886 | 31 | 9°60093 | 37 | 10°39907 | 9°96793 | 16 |
| 45 | 9°56917 | 32 | 9°60130 | 36 | 10°39870 | 9°96788 | 15 |
| 46 | 9°56949 | 31 | 9°60166 | 37 | 10°39834 | 9°96783 | 14 |
| 47 | 9°56980 | 32 | 9°60203 | 37 | 10°39797 | 9°96778 | 13 |
| 48 | 9°57012 | 32 | 9°60240 | 36 | 10°39760 | 9°96772 | 12 |
| 49 | 9°57044 | 31 | 9°60276 | 37 | 10°39724 | 9°96767 | 11 |
| 50 | 9°57075 | 32 | 9°60313 | 36 | 10°39687 | 9°96762 | 10 |
| 51 | 9°57107 | 31 | 9°60349 | 37 | 10°39651 | 9°96757 | 9 |
| 52 | 9°57138 | 31 | 9°60386 | 36 | 10°39614 | 9°96752 | 8 |
| 53 | 9°57169 | 32 | 9°60422 | 37 | 10°39578 | 9°96747 | 7 |
| 54 | 9°57201 | 31 | 9°60459 | 36 | 10°39541 | 9°96742 | 6 |
| 55 | 9°57232 | 32 | 9°60495 | 37 | 10°39505 | 9°96737 | 5 |
| 56 | 9°57264 | 31 | 9°60532 | 36 | 10°39468 | 9°96732 | 4 |
| 57 | 9°57295 | 32 | 9°60568 | 37 | 10°39432 | 9°96727 | 3 |
| 58 | 9°57326 | 31 | 9°60605 | 36 | 10°39395 | 9°96722 | 2 |
| 59 | 9°57358 | 32 | 9°60641 | 36 | 10°39359 | 9°96717 | 1 |
| 60 | | | | | 10°39323 | 9°96712 | 0 |
| ' | Cosine. | | Cotang. | | Tangent. | Sine. | ' |

[68 degrees.]

[22 degrees.]

| ' | Sine. | Diff. | Tangent. | Diff. | Cotang. | Cosine. | D. | ' |
|----|---------|--------|----------|-------|----------|---------|----|----|
| 30 | 9°58284 | 30 | 9°61722 | 36 | 10°38278 | 9°96562 | 6 | 30 |
| 31 | 9°58314 | 31 | 9°61752 | 36 | 10°38242 | 9°96556 | 5 | 29 |
| 32 | 9°58345 | 30 | 9°61794 | 35 | 10°38206 | 9°96551 | 5 | 28 |
| 33 | 9°58375 | 31 | 9°61830 | 35 | 10°38170 | 9°96546 | 5 | 27 |
| 34 | 9°58406 | 30 | 9°61865 | 36 | 10°38135 | 9°96541 | 6 | 26 |
| 35 | 9°58436 | 31 | 9°61901 | 35 | 10°38099 | 9°96535 | 5 | 25 |
| 36 | 9°58467 | 30 | 9°61936 | 35 | 10°38064 | 9°96530 | 5 | 24 |
| 37 | 9°58497 | 30 | 9°61972 | 36 | 10°38028 | 9°96525 | 5 | 23 |
| 38 | 9°58527 | 30 | 9°62008 | 35 | 10°37992 | 9°96520 | 6 | 22 |
| 39 | 9°58557 | 31 | 9°62043 | 35 | 10°37957 | 9°96514 | 5 | 21 |
| 40 | 9°58588 | 30 | 9°62079 | 35 | 10°37921 | 9°96509 | 5 | 20 |
| 41 | 9°58618 | 30 | 9°62114 | 36 | 10°37886 | 9°96504 | 6 | 19 |
| 42 | 9°58648 | 30 | 9°62150 | 35 | 10°37850 | 9°96498 | 5 | 18 |
| 43 | 9°58678 | 31 | 9°62185 | 36 | 10°37815 | 9°96493 | 5 | 17 |
| 44 | 9°58709 | 30 | 9°62221 | 35 | 10°37779 | 9°96488 | 5 | 16 |
| 45 | 9°58739 | 30 | 9°62256 | 36 | 10°37744 | 9°96483 | 6 | 15 |
| 46 | 9°58769 | 30 | 9°62292 | 35 | 10°37708 | 9°96477 | 5 | 14 |
| 47 | 9°58799 | 30 | 9°62327 | 35 | 10°37673 | 9°96472 | 5 | 13 |
| 48 | 9°58829 | 30 | 9°62362 | 36 | 10°37638 | 9°96467 | 6 | 12 |
| 49 | 9°58859 | 30 | 9°62398 | 35 | 10°37602 | 9°96461 | 5 | 11 |
| 50 | 9°58889 | 30 | 9°62433 | 35 | 10°37567 | 9°96456 | 5 | 10 |
| 51 | 9°58919 | 30 | 9°62468 | 36 | 10°37532 | 9°96451 | 6 | 9 |
| 52 | 9°58949 | 30 | 9°62504 | 35 | 10°37496 | 9°96445 | 5 | 8 |
| 53 | 9°58979 | 30 | 9°62539 | 35 | 10°37461 | 9°96440 | 5 | 7 |
| 54 | 9°59009 | 30 | 9°62574 | 35 | 10°37426 | 9°96435 | 6 | 6 |
| 55 | 9°59039 | 30 | 9°62609 | 36 | 10°37391 | 9°96429 | 5 | 5 |
| 56 | 9°59069 | 29 | 9°62645 | 35 | 10°37355 | 9°96424 | 5 | 4 |
| 57 | 9°59098 | 30 | 9°62680 | 35 | 10°37320 | 9°96419 | 6 | 3 |
| 58 | 9°59128 | 30 | 9°62715 | 35 | 10°37285 | 9°96413 | 5 | 2 |
| 59 | 9°59158 | 30 | 9°62750 | 35 | 10°37250 | 9°96408 | 5 | 1 |
| 60 | 9°59188 | 30 | 9°62785 | 35 | 10°37215 | 9°96403 | 5 | 0 |
| ' | Cosine. | Coang. | Tangent. | Sine. | | | | |

[67 degrees.]

[22 degrees.]

| ' | Sine. | Diff. | Tangent. | Diff. | Cotang. | Cosine. | D. | ' |
|----|---------|---------|----------|-------|----------|---------|----|----|
| 0 | 9°57358 | 31 | 9°60641 | 36 | 10°39359 | 9°96717 | 6 | 60 |
| 1 | 9°57389 | 31 | 9°60677 | 37 | 10°39323 | 9°96711 | 5 | 59 |
| 2 | 9°57420 | 31 | 9°60714 | 36 | 10°39286 | 9°96706 | 5 | 58 |
| 3 | 9°57451 | 31 | 9°60750 | 36 | 10°39250 | 9°96701 | 5 | 57 |
| 4 | 9°57482 | 32 | 9°60786 | 37 | 10°39214 | 9°96696 | 5 | 56 |
| 5 | 9°57514 | 31 | 9°60823 | 36 | 10°39177 | 9°96691 | 5 | 55 |
| 6 | 9°57545 | 31 | 9°60859 | 36 | 10°39141 | 9°96686 | 5 | 54 |
| 7 | 9°57576 | 31 | 9°60895 | 36 | 10°39105 | 9°96681 | 5 | 53 |
| 8 | 9°57607 | 31 | 9°60931 | 36 | 10°39069 | 9°96676 | 6 | 52 |
| 9 | 9°57638 | 31 | 9°60967 | 37 | 10°39033 | 9°96670 | 5 | 51 |
| 10 | 9°57669 | 31 | 9°61004 | 36 | 10°38998 | 9°96665 | 5 | 50 |
| 11 | 9°57700 | 31 | 9°61040 | 36 | 10°38960 | 9°96660 | 5 | 49 |
| 12 | 9°57731 | 31 | 9°61076 | 36 | 10°38924 | 9°96655 | 5 | 48 |
| 13 | 9°57762 | 31 | 9°61112 | 36 | 10°38888 | 9°96650 | 5 | 47 |
| 14 | 9°57793 | 31 | 9°61148 | 36 | 10°38852 | 9°96645 | 5 | 46 |
| 15 | 9°57824 | 31 | 9°61184 | 36 | 10°38816 | 9°96640 | 6 | 45 |
| 16 | 9°57855 | 30 | 9°61220 | 36 | 10°38780 | 9°96634 | 5 | 44 |
| 17 | 9°57885 | 31 | 9°61256 | 36 | 10°38744 | 9°96629 | 5 | 43 |
| 18 | 9°57916 | 31 | 9°61292 | 36 | 10°38708 | 9°96624 | 5 | 42 |
| 19 | 9°57947 | 31 | 9°61328 | 36 | 10°38672 | 9°96619 | 5 | 41 |
| 20 | 9°57978 | 30 | 9°61364 | 36 | 10°38636 | 9°96614 | 6 | 40 |
| 21 | 9°58008 | 31 | 9°61400 | 36 | 10°38600 | 9°96608 | 5 | 39 |
| 22 | 9°58039 | 31 | 9°61436 | 36 | 10°38564 | 9°96603 | 5 | 38 |
| 23 | 9°58070 | 31 | 9°61472 | 36 | 10°38528 | 9°96598 | 5 | 37 |
| 24 | 9°58101 | 30 | 9°61508 | 36 | 10°38492 | 9°96593 | 5 | 36 |
| 25 | 9°58131 | 31 | 9°61544 | 35 | 10°38456 | 9°96588 | 6 | 35 |
| 26 | 9°58162 | 30 | 9°61579 | 36 | 10°38421 | 9°96582 | 5 | 34 |
| 27 | 9°58192 | 31 | 9°61615 | 36 | 10°38385 | 9°96577 | 5 | 33 |
| 28 | 9°58223 | 30 | 9°61651 | 36 | 10°38349 | 9°96572 | 5 | 32 |
| 29 | 9°58253 | 31 | 9°61687 | 35 | 10°38313 | 9°96567 | 5 | 31 |
| 30 | 9°58284 | 31 | 9°61722 | 35 | 10°38278 | 9°96562 | 5 | 30 |
| ' | Cosine. | Cotang. | Tangent. | Sine. | | | | |

[67 degrees.]

[23 degrees.]

| ' | Sine. | Diff. | Tangent. | Diff. | Cotang. | Cosine. | D. | ' |
|----|---------|-------|----------|-------|----------|---------|----|----|
| 0 | 9°59188 | 30 | 9°62785 | 35 | 10°37215 | 9°64093 | 6 | 60 |
| 1 | 9°59218 | 29 | 9°62820 | 35 | 10°37180 | 9°63997 | 5 | 59 |
| 2 | 9°59247 | 30 | 9°62855 | 35 | 10°37145 | 9°63922 | 5 | 58 |
| 3 | 9°59277 | 30 | 9°62890 | 35 | 10°37110 | 9°63847 | 6 | 57 |
| 4 | 9°59307 | 29 | 9°62926 | 35 | 10°37074 | 9°63761 | 5 | 56 |
| 5 | 9°59336 | 30 | 9°62961 | 35 | 10°37039 | 9°63676 | 6 | 55 |
| 6 | 9°59366 | 30 | 9°62996 | 35 | 10°37004 | 9°63590 | 6 | 54 |
| 7 | 9°59396 | 29 | 9°63031 | 35 | 10°36969 | 9°63505 | 5 | 53 |
| 8 | 9°59425 | 30 | 9°63066 | 35 | 10°36934 | 9°63420 | 5 | 52 |
| 9 | 9°59455 | 29 | 9°63101 | 34 | 10°36899 | 9°63335 | 6 | 51 |
| 10 | 9°59484 | 30 | 9°63135 | 35 | 10°36863 | 9°63249 | 6 | 50 |
| 11 | 9°59514 | 29 | 9°63170 | 35 | 10°36828 | 9°63164 | 6 | 49 |
| 12 | 9°59543 | 30 | 9°63205 | 35 | 10°36793 | 9°63078 | 5 | 48 |
| 13 | 9°59573 | 29 | 9°63240 | 35 | 10°36758 | 9°62993 | 6 | 47 |
| 14 | 9°59602 | 30 | 9°63275 | 35 | 10°36723 | 9°62907 | 5 | 46 |
| 15 | 9°59632 | 29 | 9°63310 | 35 | 10°36688 | 9°62822 | 6 | 45 |
| 16 | 9°59661 | 29 | 9°63345 | 34 | 10°36653 | 9°62736 | 5 | 44 |
| 17 | 9°59690 | 30 | 9°63379 | 35 | 10°36618 | 9°62651 | 6 | 43 |
| 18 | 9°59720 | 29 | 9°63414 | 35 | 10°36583 | 9°62565 | 5 | 42 |
| 19 | 9°59749 | 29 | 9°63449 | 35 | 10°36548 | 9°62480 | 6 | 41 |
| 20 | 9°59778 | 30 | 9°63484 | 35 | 10°36513 | 9°62394 | 5 | 40 |
| 21 | 9°59808 | 29 | 9°63519 | 34 | 10°36478 | 9°62309 | 6 | 39 |
| 22 | 9°59837 | 29 | 9°63553 | 35 | 10°36443 | 9°62223 | 5 | 38 |
| 23 | 9°59866 | 29 | 9°63588 | 35 | 10°36408 | 9°62138 | 6 | 37 |
| 24 | 9°59895 | 29 | 9°63623 | 34 | 10°36373 | 9°62052 | 5 | 36 |
| 25 | 9°59924 | 30 | 9°63657 | 35 | 10°36338 | 9°61967 | 6 | 35 |
| 26 | 9°59954 | 29 | 9°63692 | 34 | 10°36303 | 9°61881 | 6 | 34 |
| 27 | 9°59983 | 29 | 9°63726 | 35 | 10°36268 | 9°61796 | 5 | 33 |
| 28 | 9°60012 | 29 | 9°63761 | 35 | 10°36233 | 9°61710 | 6 | 32 |
| 29 | 9°60041 | 29 | 9°63796 | 34 | 10°36198 | 9°61625 | 5 | 31 |
| 30 | 9°60070 | 29 | 9°63830 | 34 | 10°36170 | 9°61540 | 5 | 30 |

[66 degrees.]

[23 degrees.]

| ' | Sine. | Diff. | Tangent. | Diff. | Cotang. | Cosine. | D. | ' |
|----|---------|-------|----------|-------|----------|---------|----|----|
| 30 | 9°60099 | 29 | 9°63865 | 35 | 10°36170 | 9°61454 | 6 | 30 |
| 31 | 9°60128 | 29 | 9°63899 | 34 | 10°36135 | 9°61369 | 6 | 29 |
| 32 | 9°60158 | 29 | 9°63934 | 35 | 10°36101 | 9°61284 | 5 | 28 |
| 33 | 9°60187 | 29 | 9°63968 | 34 | 10°36066 | 9°61199 | 6 | 27 |
| 34 | 9°60216 | 29 | 9°64003 | 35 | 10°36032 | 9°61114 | 5 | 26 |
| 35 | 9°60245 | 29 | 9°64037 | 34 | 10°35997 | 9°61029 | 6 | 25 |
| 36 | 9°60274 | 29 | 9°64072 | 35 | 10°35963 | 9°60944 | 5 | 24 |
| 37 | 9°60302 | 29 | 9°64106 | 34 | 10°35928 | 9°60859 | 6 | 23 |
| 38 | 9°60331 | 29 | 9°64140 | 35 | 10°35894 | 9°60774 | 5 | 22 |
| 39 | 9°60359 | 29 | 9°64175 | 34 | 10°35860 | 9°60689 | 6 | 21 |
| 40 | 9°60388 | 29 | 9°64209 | 35 | 10°35825 | 9°60604 | 5 | 20 |
| 41 | 9°60417 | 29 | 9°64243 | 34 | 10°35791 | 9°60519 | 6 | 19 |
| 42 | 9°60446 | 28 | 9°64278 | 35 | 10°35757 | 9°60434 | 5 | 18 |
| 43 | 9°60474 | 29 | 9°64312 | 34 | 10°35722 | 9°60349 | 6 | 17 |
| 44 | 9°60503 | 29 | 9°64346 | 35 | 10°35688 | 9°60264 | 5 | 16 |
| 45 | 9°60532 | 29 | 9°64381 | 34 | 10°35654 | 9°60179 | 6 | 15 |
| 46 | 9°60561 | 28 | 9°64415 | 35 | 10°35619 | 9°60094 | 5 | 14 |
| 47 | 9°60589 | 29 | 9°64449 | 34 | 10°35585 | 9°60009 | 6 | 13 |
| 48 | 9°60618 | 28 | 9°64483 | 35 | 10°35551 | 9°59924 | 5 | 12 |
| 49 | 9°60646 | 29 | 9°64517 | 34 | 10°35517 | 9°59839 | 6 | 11 |
| 50 | 9°60675 | 29 | 9°64552 | 35 | 10°35483 | 9°59754 | 5 | 10 |
| 51 | 9°60704 | 28 | 9°64586 | 34 | 10°35448 | 9°59669 | 6 | 9 |
| 52 | 9°60732 | 29 | 9°64620 | 35 | 10°35414 | 9°59584 | 5 | 8 |
| 53 | 9°60761 | 28 | 9°64654 | 34 | 10°35380 | 9°59499 | 6 | 7 |
| 54 | 9°60789 | 29 | 9°64688 | 35 | 10°35346 | 9°59414 | 5 | 6 |
| 55 | 9°60818 | 28 | 9°64722 | 34 | 10°35312 | 9°59329 | 6 | 5 |
| 56 | 9°60846 | 29 | 9°64756 | 35 | 10°35278 | 9°59244 | 5 | 4 |
| 57 | 9°60875 | 28 | 9°64790 | 34 | 10°35244 | 9°59159 | 6 | 3 |
| 58 | 9°60903 | 29 | 9°64824 | 35 | 10°35210 | 9°59074 | 5 | 2 |
| 59 | 9°60931 | 28 | 9°64858 | 34 | 10°35176 | 9°58989 | 6 | 1 |
| 60 | 9°60959 | 29 | 9°64892 | 35 | 10°35142 | 9°58904 | 5 | 0 |

[66 degrees.]

[24 degrees.]

| ' | Sine. | Diff. | Tangent. | Diff. | Cotang. | Cosine. | D. | ' |
|----|---------|-------|----------|-------|----------|---------|----|----|
| 0 | 9°60931 | 29 | 9°64858 | 34 | 10°35142 | 9°96073 | 6 | 60 |
| 1 | 9°60960 | 28 | 9°64892 | 34 | 10°35108 | 9°96067 | 5 | 59 |
| 2 | 9°60988 | 28 | 9°64926 | 34 | 10°35074 | 9°96062 | 5 | 58 |
| 3 | 9°61016 | 28 | 9°64960 | 34 | 10°35040 | 9°96056 | 6 | 57 |
| 4 | 9°61045 | 29 | 9°64994 | 34 | 10°35006 | 9°96050 | 5 | 56 |
| 5 | 9°61073 | 28 | 9°65028 | 34 | 10°34972 | 9°96045 | 5 | 55 |
| 6 | 9°61101 | 28 | 9°65062 | 34 | 10°34938 | 9°96039 | 6 | 54 |
| 7 | 9°61129 | 28 | 9°65096 | 34 | 10°34904 | 9°96034 | 5 | 53 |
| 8 | 9°61158 | 28 | 9°65130 | 34 | 10°34870 | 9°96028 | 6 | 52 |
| 9 | 9°61186 | 28 | 9°65164 | 34 | 10°34836 | 9°96022 | 5 | 51 |
| 10 | 9°61214 | 28 | 9°65197 | 34 | 10°34803 | 9°96017 | 5 | 50 |
| 11 | 9°61242 | 28 | 9°65231 | 34 | 10°34769 | 9°96011 | 6 | 49 |
| 12 | 9°61270 | 28 | 9°65265 | 34 | 10°34735 | 9°96005 | 5 | 48 |
| 13 | 9°61298 | 28 | 9°65299 | 34 | 10°34701 | 9°96000 | 6 | 47 |
| 14 | 9°61326 | 28 | 9°65333 | 33 | 10°34667 | 9°95994 | 6 | 46 |
| 15 | 9°61354 | 28 | 9°65366 | 34 | 10°34634 | 9°95988 | 6 | 45 |
| 16 | 9°61382 | 29 | 9°65400 | 34 | 10°34600 | 9°95982 | 6 | 44 |
| 17 | 9°61411 | 27 | 9°65434 | 33 | 10°34566 | 9°95977 | 5 | 43 |
| 18 | 9°61438 | 28 | 9°65467 | 34 | 10°34533 | 9°95971 | 6 | 42 |
| 19 | 9°61466 | 28 | 9°65501 | 34 | 10°34499 | 9°95965 | 5 | 41 |
| 20 | 9°61494 | 28 | 9°65535 | 33 | 10°34465 | 9°95960 | 6 | 40 |
| 21 | 9°61522 | 28 | 9°65568 | 34 | 10°34432 | 9°95954 | 6 | 39 |
| 22 | 9°61550 | 28 | 9°65602 | 34 | 10°34398 | 9°95948 | 6 | 38 |
| 23 | 9°61578 | 28 | 9°65636 | 33 | 10°34364 | 9°95942 | 5 | 37 |
| 24 | 9°61606 | 28 | 9°65669 | 34 | 10°34331 | 9°95937 | 6 | 36 |
| 25 | 9°61634 | 28 | 9°65703 | 33 | 10°34297 | 9°95931 | 6 | 35 |
| 26 | 9°61662 | 27 | 9°65736 | 34 | 10°34264 | 9°95925 | 5 | 34 |
| 27 | 9°61689 | 28 | 9°65770 | 34 | 10°34230 | 9°95920 | 6 | 33 |
| 28 | 9°61717 | 28 | 9°65803 | 33 | 10°34197 | 9°95914 | 6 | 32 |
| 29 | 9°61745 | 28 | 9°65837 | 33 | 10°34163 | 9°95908 | 6 | 31 |
| 30 | 9°61773 | | 9°65870 | 33 | 10°34130 | 9°95902 | 6 | 30 |
| ' | Cosine. | | Cotang. | | Tangent. | Sine. | | ' |

[65 degrees.]

[24 degrees.]

| ' | Sine. | Diff. | Tangent. | Diff. | Cotang. | Cosine. | D. | ' |
|----|---------|-------|----------|-------|----------|---------|----|----|
| 30 | 9°61773 | 27 | 9°65870 | 34 | 10°34130 | 9°95902 | 5 | 30 |
| 31 | 9°61800 | 28 | 9°65904 | 33 | 10°34096 | 9°95897 | 6 | 29 |
| 32 | 9°61828 | 28 | 9°65937 | 34 | 10°34063 | 9°95891 | 6 | 28 |
| 33 | 9°61856 | 28 | 9°65971 | 34 | 10°34029 | 9°95885 | 6 | 27 |
| 34 | 9°61883 | 28 | 9°66004 | 33 | 10°33996 | 9°95879 | 6 | 26 |
| 35 | 9°61911 | 28 | 9°66038 | 34 | 10°33962 | 9°95873 | 5 | 25 |
| 36 | 9°61939 | 28 | 9°66071 | 33 | 10°33929 | 9°95868 | 5 | 24 |
| 37 | 9°61966 | 27 | 9°66104 | 34 | 10°33896 | 9°95862 | 6 | 23 |
| 38 | 9°61994 | 27 | 9°66138 | 33 | 10°33862 | 9°95856 | 6 | 22 |
| 39 | 9°62021 | 28 | 9°66171 | 33 | 10°33829 | 9°95850 | 6 | 21 |
| 40 | 9°62049 | 27 | 9°66204 | 34 | 10°33796 | 9°95844 | 5 | 20 |
| 41 | 9°62076 | 28 | 9°66238 | 33 | 10°33762 | 9°95839 | 5 | 19 |
| 42 | 9°62104 | 27 | 9°66271 | 33 | 10°33729 | 9°95833 | 6 | 18 |
| 43 | 9°62131 | 28 | 9°66304 | 33 | 10°33696 | 9°95827 | 6 | 17 |
| 44 | 9°62159 | 27 | 9°66337 | 34 | 10°33663 | 9°95821 | 6 | 16 |
| 45 | 9°62186 | 28 | 9°66371 | 33 | 10°33629 | 9°95815 | 5 | 15 |
| 46 | 9°62214 | 27 | 9°66404 | 33 | 10°33596 | 9°95810 | 5 | 14 |
| 47 | 9°62241 | 27 | 9°66437 | 33 | 10°33563 | 9°95804 | 6 | 13 |
| 48 | 9°62268 | 28 | 9°66470 | 33 | 10°33530 | 9°95798 | 6 | 12 |
| 49 | 9°62296 | 27 | 9°66503 | 34 | 10°33497 | 9°95792 | 6 | 11 |
| 50 | 9°62323 | 27 | 9°66537 | 33 | 10°33463 | 9°95786 | 6 | 10 |
| 51 | 9°62350 | 27 | 9°66570 | 33 | 10°33430 | 9°95780 | 6 | 9 |
| 52 | 9°62377 | 28 | 9°66603 | 33 | 10°33397 | 9°95775 | 5 | 8 |
| 53 | 9°62405 | 27 | 9°66636 | 33 | 10°33364 | 9°95769 | 6 | 7 |
| 54 | 9°62432 | 27 | 9°66669 | 33 | 10°33331 | 9°95763 | 6 | 6 |
| 55 | 9°62459 | 27 | 9°66702 | 33 | 10°33298 | 9°95757 | 6 | 5 |
| 56 | 9°62486 | 28 | 9°66735 | 33 | 10°33265 | 9°95751 | 6 | 4 |
| 57 | 9°62513 | 27 | 9°66768 | 33 | 10°33232 | 9°95745 | 6 | 3 |
| 58 | 9°62541 | 28 | 9°66801 | 33 | 10°33199 | 9°95739 | 6 | 2 |
| 59 | 9°62568 | 27 | 9°66834 | 33 | 10°33166 | 9°95733 | 5 | 1 |
| 60 | 9°62595 | 27 | 9°66867 | 33 | 10°33133 | 9°95728 | 5 | 0 |
| ' | Cosine. | | Cotang. | | Tangent. | Sine. | | ' |

[65 degrees.]

[25 degrees.]

| ' | Sine. | Diff. | Tangent. | Diff. | Cotang. | Diff. | Cotang. | Diff. | ' |
|----|---------|-------|----------|-------|----------|-------|---------|-------|----|
| 30 | 9°63398 | 27 | 9°67850 | 32 | 10°32150 | 32 | 9°95549 | 6 | 30 |
| 31 | 9°63425 | 26 | 9°67882 | 33 | 10°32118 | 33 | 9°95543 | 6 | 29 |
| 32 | 9°63451 | 27 | 9°67915 | 32 | 10°32085 | 32 | 9°95537 | 6 | 28 |
| 33 | 9°63478 | 26 | 9°67947 | 33 | 10°32053 | 33 | 9°95531 | 6 | 27 |
| 34 | 9°63504 | 27 | 9°67980 | 32 | 10°32020 | 32 | 9°95525 | 6 | 26 |
| 35 | 9°63531 | 26 | 9°68012 | 33 | 10°31988 | 33 | 9°95519 | 6 | 25 |
| 36 | 9°63557 | 26 | 9°68044 | 32 | 10°31956 | 32 | 9°95513 | 6 | 24 |
| 37 | 9°63583 | 27 | 9°68077 | 33 | 10°31923 | 33 | 9°95507 | 6 | 23 |
| 38 | 9°63610 | 26 | 9°68109 | 32 | 10°31891 | 32 | 9°95500 | 6 | 22 |
| 39 | 9°63636 | 26 | 9°68142 | 33 | 10°31858 | 33 | 9°95494 | 6 | 21 |
| 40 | 9°63662 | 27 | 9°68174 | 32 | 10°31825 | 32 | 9°95488 | 6 | 20 |
| 41 | 9°63689 | 26 | 9°68206 | 33 | 10°31794 | 33 | 9°95482 | 6 | 19 |
| 42 | 9°63715 | 26 | 9°68239 | 32 | 10°31761 | 32 | 9°95476 | 6 | 18 |
| 43 | 9°63741 | 26 | 9°68271 | 33 | 10°31729 | 33 | 9°95470 | 6 | 17 |
| 44 | 9°63767 | 27 | 9°68303 | 32 | 10°31697 | 32 | 9°95464 | 6 | 16 |
| 45 | 9°63794 | 26 | 9°68336 | 33 | 10°31664 | 33 | 9°95458 | 6 | 15 |
| 46 | 9°63820 | 26 | 9°68368 | 32 | 10°31632 | 32 | 9°95452 | 6 | 14 |
| 47 | 9°63846 | 26 | 9°68400 | 33 | 10°31600 | 33 | 9°95446 | 6 | 13 |
| 48 | 9°63872 | 26 | 9°68432 | 32 | 10°31568 | 32 | 9°95440 | 6 | 12 |
| 49 | 9°63898 | 26 | 9°68465 | 33 | 10°31535 | 33 | 9°95434 | 6 | 11 |
| 50 | 9°63924 | 26 | 9°68497 | 32 | 10°31503 | 32 | 9°95427 | 6 | 10 |
| 51 | 9°63950 | 26 | 9°68529 | 33 | 10°31471 | 33 | 9°95421 | 6 | 9 |
| 52 | 9°63976 | 26 | 9°68561 | 32 | 10°31439 | 32 | 9°95415 | 6 | 8 |
| 53 | 9°64002 | 26 | 9°68593 | 33 | 10°31407 | 33 | 9°95409 | 6 | 7 |
| 54 | 9°64028 | 26 | 9°68626 | 32 | 10°31374 | 32 | 9°95403 | 6 | 6 |
| 55 | 9°64054 | 26 | 9°68658 | 33 | 10°31342 | 33 | 9°95397 | 6 | 5 |
| 56 | 9°64080 | 26 | 9°68690 | 32 | 10°31310 | 32 | 9°95391 | 6 | 4 |
| 57 | 9°64106 | 26 | 9°68722 | 33 | 10°31278 | 33 | 9°95384 | 6 | 3 |
| 58 | 9°64132 | 26 | 9°68754 | 32 | 10°31246 | 32 | 9°95378 | 6 | 2 |
| 59 | 9°64158 | 26 | 9°68786 | 33 | 10°31214 | 33 | 9°95372 | 6 | 1 |
| 60 | 9°64184 | 26 | 9°68818 | 32 | 10°31182 | 32 | 9°95366 | 6 | 0 |

[64 degrees.]

[25 degrees.]

| ' | Sine. | Diff. | Tangent. | Diff. | Cotang. | Diff. | Cotang. | Diff. | ' |
|----|---------|-------|----------|-------|----------|-------|---------|-------|----|
| 0 | 9°62595 | 27 | 9°66867 | 33 | 10°33133 | 33 | 9°95728 | 6 | 60 |
| 1 | 9°62622 | 27 | 9°66900 | 33 | 10°33100 | 33 | 9°95722 | 6 | 59 |
| 2 | 9°62649 | 27 | 9°66933 | 33 | 10°33067 | 33 | 9°95716 | 6 | 58 |
| 3 | 9°62676 | 27 | 9°66966 | 33 | 10°33034 | 33 | 9°95710 | 6 | 57 |
| 4 | 9°62703 | 27 | 9°66999 | 33 | 10°33001 | 33 | 9°95704 | 6 | 56 |
| 5 | 9°62730 | 27 | 9°67032 | 33 | 10°32968 | 33 | 9°95698 | 6 | 55 |
| 6 | 9°62757 | 27 | 9°67065 | 33 | 10°32935 | 33 | 9°95692 | 6 | 54 |
| 7 | 9°62784 | 27 | 9°67098 | 33 | 10°32902 | 33 | 9°95686 | 6 | 53 |
| 8 | 9°62811 | 27 | 9°67131 | 33 | 10°32869 | 33 | 9°95680 | 6 | 52 |
| 9 | 9°62838 | 27 | 9°67163 | 33 | 10°32837 | 33 | 9°95674 | 6 | 51 |
| 10 | 9°62865 | 27 | 9°67196 | 33 | 10°32804 | 33 | 9°95668 | 6 | 50 |
| 11 | 9°62892 | 26 | 9°67229 | 33 | 10°32771 | 33 | 9°95663 | 6 | 49 |
| 12 | 9°62918 | 27 | 9°67262 | 33 | 10°32738 | 33 | 9°95657 | 6 | 48 |
| 13 | 9°62945 | 27 | 9°67295 | 33 | 10°32705 | 33 | 9°95651 | 6 | 47 |
| 14 | 9°62972 | 27 | 9°67327 | 33 | 10°32673 | 33 | 9°95645 | 6 | 46 |
| 15 | 9°62999 | 27 | 9°67360 | 33 | 10°32640 | 33 | 9°95639 | 6 | 45 |
| 16 | 9°63026 | 26 | 9°67393 | 33 | 10°32607 | 33 | 9°95633 | 6 | 44 |
| 17 | 9°63053 | 27 | 9°67426 | 32 | 10°32574 | 32 | 9°95627 | 6 | 43 |
| 18 | 9°63079 | 27 | 9°67458 | 33 | 10°32542 | 33 | 9°95621 | 6 | 42 |
| 19 | 9°63106 | 27 | 9°67491 | 33 | 10°32509 | 33 | 9°95615 | 6 | 41 |
| 20 | 9°63133 | 26 | 9°67524 | 32 | 10°32476 | 32 | 9°95609 | 6 | 40 |
| 21 | 9°63159 | 27 | 9°67556 | 33 | 10°32444 | 33 | 9°95603 | 6 | 39 |
| 22 | 9°63186 | 27 | 9°67589 | 33 | 10°32411 | 33 | 9°95597 | 6 | 38 |
| 23 | 9°63213 | 26 | 9°67622 | 32 | 10°32378 | 32 | 9°95591 | 6 | 37 |
| 24 | 9°63239 | 27 | 9°67654 | 33 | 10°32346 | 33 | 9°95585 | 6 | 36 |
| 25 | 9°63266 | 26 | 9°67687 | 32 | 10°32313 | 32 | 9°95579 | 6 | 35 |
| 26 | 9°63292 | 27 | 9°67719 | 33 | 10°32281 | 33 | 9°95573 | 6 | 34 |
| 27 | 9°63319 | 26 | 9°67752 | 33 | 10°32248 | 33 | 9°95567 | 6 | 33 |
| 28 | 9°63345 | 27 | 9°67785 | 32 | 10°32215 | 32 | 9°95561 | 6 | 32 |
| 29 | 9°63372 | 26 | 9°67817 | 33 | 10°32183 | 33 | 9°95555 | 6 | 31 |
| 30 | 9°63398 | 26 | 9°67850 | 32 | 10°32150 | 32 | 9°95549 | 6 | 30 |

[64 degrees.]

[26 degrees.]

| | Sine. | Diff. | Tangent. | Diff. | Cotang. | Cosine. | D. |
|----|----------|-------|----------|-------|-----------|----------|----|
| 30 | 9° 64953 | 25 | 9° 66774 | 31 | 10° 30226 | 9° 95179 | 6 |
| 31 | 9° 64978 | 25 | 9° 66805 | 32 | 10° 30195 | 9° 95173 | 6 |
| 32 | 9° 65003 | 26 | 9° 66837 | 31 | 10° 30163 | 9° 95167 | 7 |
| 33 | 9° 65029 | 25 | 9° 66868 | 32 | 10° 30132 | 9° 95160 | 6 |
| 34 | 9° 65054 | 25 | 9° 66900 | 32 | 10° 30100 | 9° 95154 | 6 |
| 35 | 9° 65079 | 25 | 9° 66932 | 31 | 10° 30068 | 9° 95148 | 7 |
| 36 | 9° 65104 | 26 | 9° 66963 | 32 | 10° 30037 | 9° 95141 | 7 |
| 37 | 9° 65130 | 25 | 9° 66995 | 31 | 10° 30005 | 9° 95135 | 6 |
| 38 | 9° 65155 | 25 | 9° 70026 | 32 | 10° 29974 | 9° 95129 | 7 |
| 39 | 9° 65180 | 25 | 9° 70058 | 31 | 10° 29942 | 9° 95122 | 6 |
| 40 | 9° 65205 | 25 | 9° 70090 | 32 | 10° 29911 | 9° 95116 | 6 |
| 41 | 9° 65230 | 25 | 9° 70121 | 31 | 10° 29879 | 9° 95110 | 7 |
| 42 | 9° 65255 | 26 | 9° 70152 | 32 | 10° 29848 | 9° 95103 | 6 |
| 43 | 9° 65281 | 25 | 9° 70184 | 31 | 10° 29816 | 9° 95097 | 7 |
| 44 | 9° 65306 | 25 | 9° 70215 | 32 | 10° 29785 | 9° 95090 | 6 |
| 45 | 9° 65331 | 25 | 9° 70247 | 31 | 10° 29753 | 9° 95084 | 6 |
| 46 | 9° 65356 | 25 | 9° 70278 | 32 | 10° 29722 | 9° 95078 | 7 |
| 47 | 9° 65381 | 25 | 9° 70309 | 31 | 10° 29691 | 9° 95071 | 6 |
| 48 | 9° 65406 | 25 | 9° 70341 | 32 | 10° 29659 | 9° 95065 | 6 |
| 49 | 9° 65431 | 25 | 9° 70372 | 31 | 10° 29628 | 9° 95059 | 7 |
| 50 | 9° 65456 | 25 | 9° 70404 | 32 | 10° 29596 | 9° 95052 | 6 |
| 51 | 9° 65481 | 25 | 9° 70435 | 31 | 10° 29565 | 9° 95046 | 7 |
| 52 | 9° 65506 | 25 | 9° 70466 | 32 | 10° 29534 | 9° 95039 | 7 |
| 53 | 9° 65531 | 25 | 9° 70498 | 31 | 10° 29502 | 9° 95033 | 6 |
| 54 | 9° 65556 | 24 | 9° 70529 | 32 | 10° 29471 | 9° 95027 | 6 |
| 55 | 9° 65580 | 25 | 9° 70560 | 31 | 10° 29440 | 9° 95020 | 7 |
| 56 | 9° 65605 | 25 | 9° 70592 | 32 | 10° 29408 | 9° 95014 | 4 |
| 57 | 9° 65630 | 25 | 9° 70623 | 31 | 10° 29377 | 9° 95007 | 7 |
| 58 | 9° 65655 | 25 | 9° 70654 | 32 | 10° 29346 | 9° 95001 | 6 |
| 59 | 9° 65680 | 25 | 9° 70685 | 31 | 10° 29315 | 9° 94995 | 2 |
| 60 | 9° 65705 | 25 | 9° 70717 | 32 | 10° 29283 | 9° 94988 | 7 |

[63 degrees.]

[26 degrees.]

| | Sine. | Diff. | Tangent. | Diff. | Cotang. | Cosine. | D. |
|----|----------|-------|----------|-------|-----------|----------|----|
| 0 | 9° 64184 | 26 | 9° 68818 | 32 | 10° 31182 | 9° 95366 | 60 |
| 1 | 9° 64210 | 26 | 9° 68850 | 32 | 10° 31150 | 9° 95360 | 6 |
| 2 | 9° 64236 | 26 | 9° 68882 | 32 | 10° 31118 | 9° 95354 | 6 |
| 3 | 9° 64262 | 26 | 9° 68914 | 32 | 10° 31086 | 9° 95348 | 57 |
| 4 | 9° 64288 | 26 | 9° 68946 | 32 | 10° 31054 | 9° 95341 | 6 |
| 5 | 9° 64313 | 26 | 9° 68978 | 32 | 10° 31022 | 9° 95335 | 55 |
| 6 | 9° 64339 | 26 | 9° 69010 | 32 | 10° 30990 | 9° 95329 | 6 |
| 7 | 9° 64365 | 26 | 9° 69042 | 32 | 10° 30958 | 9° 95323 | 54 |
| 8 | 9° 64391 | 26 | 9° 69074 | 32 | 10° 30926 | 9° 95317 | 52 |
| 9 | 9° 64417 | 26 | 9° 69106 | 32 | 10° 30894 | 9° 95310 | 6 |
| 10 | 9° 64442 | 26 | 9° 69138 | 32 | 10° 30862 | 9° 95304 | 51 |
| 11 | 9° 64468 | 26 | 9° 69170 | 32 | 10° 30830 | 9° 95298 | 50 |
| 12 | 9° 64494 | 26 | 9° 69202 | 32 | 10° 30798 | 9° 95292 | 48 |
| 13 | 9° 64519 | 26 | 9° 69234 | 32 | 10° 30766 | 9° 95286 | 47 |
| 14 | 9° 64545 | 26 | 9° 69266 | 32 | 10° 30734 | 9° 95279 | 46 |
| 15 | 9° 64571 | 25 | 9° 69298 | 31 | 10° 30702 | 9° 95273 | 6 |
| 16 | 9° 64596 | 26 | 9° 69329 | 32 | 10° 30671 | 9° 95267 | 45 |
| 17 | 9° 64622 | 25 | 9° 69361 | 32 | 10° 30639 | 9° 95261 | 44 |
| 18 | 9° 64647 | 26 | 9° 69393 | 32 | 10° 30607 | 9° 95254 | 7 |
| 19 | 9° 64673 | 26 | 9° 69425 | 32 | 10° 30575 | 9° 95248 | 6 |
| 20 | 9° 64698 | 26 | 9° 69457 | 31 | 10° 30543 | 9° 95242 | 42 |
| 21 | 9° 64724 | 25 | 9° 69488 | 32 | 10° 30512 | 9° 95236 | 41 |
| 22 | 9° 64749 | 26 | 9° 69520 | 32 | 10° 30480 | 9° 95230 | 40 |
| 23 | 9° 64775 | 25 | 9° 69552 | 32 | 10° 30448 | 9° 95223 | 6 |
| 24 | 9° 64800 | 26 | 9° 69584 | 31 | 10° 30416 | 9° 95217 | 36 |
| 25 | 9° 64826 | 25 | 9° 69615 | 32 | 10° 30385 | 9° 95211 | 35 |
| 26 | 9° 64851 | 26 | 9° 69647 | 32 | 10° 30353 | 9° 95204 | 34 |
| 27 | 9° 64877 | 25 | 9° 69679 | 31 | 10° 30321 | 9° 95198 | 6 |
| 28 | 9° 64902 | 25 | 9° 69710 | 32 | 10° 30290 | 9° 95192 | 33 |
| 29 | 9° 64927 | 26 | 9° 69742 | 32 | 10° 30258 | 9° 95185 | 32 |
| 30 | 9° 64953 | 26 | 9° 69774 | 32 | 10° 30226 | 9° 95179 | 30 |

[63 degrees.]

[27 degrees.]

| ' | Sine. | Diff. | Tangent. | Diff. | Cotang. | Cosine. | D. | ' |
|----|---------|-------|----------|----------|----------|---------|----|----|
| 0 | 9°5705 | 24 | 9°70717 | 31 | 10°29283 | 9°94988 | 6 | 60 |
| 1 | 9°5729 | 25 | 9°70748 | 31 | 10°29252 | 9°94982 | 7 | 59 |
| 2 | 9°5754 | 25 | 9°70779 | 31 | 10°29221 | 9°94975 | 8 | 58 |
| 3 | 9°5779 | 25 | 9°70810 | 31 | 10°29190 | 9°94969 | 9 | 57 |
| 4 | 9°5804 | 25 | 9°70841 | 31 | 10°29159 | 9°94962 | 10 | 56 |
| 5 | 9°5828 | 25 | 9°70873 | 31 | 10°29127 | 9°94956 | 11 | 55 |
| 6 | 9°5853 | 25 | 9°70904 | 31 | 10°29096 | 9°94949 | 12 | 54 |
| 7 | 9°5878 | 25 | 9°70935 | 31 | 10°29065 | 9°94943 | 13 | 53 |
| 8 | 9°5902 | 25 | 9°70966 | 31 | 10°29034 | 9°94936 | 14 | 52 |
| 9 | 9°5927 | 25 | 9°70997 | 31 | 10°29003 | 9°94930 | 15 | 51 |
| 10 | 9°5952 | 24 | 9°71028 | 31 | 10°28972 | 9°94923 | 16 | 50 |
| 11 | 9°5976 | 24 | 9°71059 | 31 | 10°28941 | 9°94917 | 17 | 49 |
| 12 | 9°6001 | 24 | 9°71090 | 31 | 10°28910 | 9°94911 | 18 | 48 |
| 13 | 9°6025 | 25 | 9°71121 | 31 | 10°28879 | 9°94904 | 19 | 47 |
| 14 | 9°6050 | 25 | 9°71153 | 31 | 10°28847 | 9°94898 | 20 | 46 |
| 15 | 9°6075 | 24 | 9°71184 | 31 | 10°28816 | 9°94891 | 21 | 45 |
| 16 | 9°6099 | 25 | 9°71215 | 31 | 10°28785 | 9°94885 | 22 | 44 |
| 17 | 9°6124 | 24 | 9°71246 | 31 | 10°28754 | 9°94878 | 23 | 43 |
| 18 | 9°6148 | 25 | 9°71277 | 31 | 10°28723 | 9°94871 | 24 | 42 |
| 19 | 9°6173 | 24 | 9°71308 | 31 | 10°28692 | 9°94865 | 25 | 41 |
| 20 | 9°6197 | 24 | 9°71339 | 31 | 10°28661 | 9°94858 | 26 | 40 |
| 21 | 9°6221 | 25 | 9°71370 | 31 | 10°28630 | 9°94852 | 27 | 39 |
| 22 | 9°6246 | 25 | 9°71401 | 30 | 10°28599 | 9°94845 | 28 | 38 |
| 23 | 9°6270 | 24 | 9°71431 | 31 | 10°28569 | 9°94839 | 29 | 37 |
| 24 | 9°6295 | 25 | 9°71462 | 31 | 10°28538 | 9°94832 | 30 | 36 |
| 25 | 9°6319 | 24 | 9°71493 | 31 | 10°28507 | 9°94826 | 31 | 35 |
| 26 | 9°6343 | 25 | 9°71524 | 31 | 10°28476 | 9°94819 | 32 | 34 |
| 27 | 9°6368 | 24 | 9°71555 | 31 | 10°28445 | 9°94813 | 33 | 33 |
| 28 | 9°6392 | 24 | 9°71586 | 31 | 10°28414 | 9°94806 | 34 | 32 |
| 29 | 9°6416 | 25 | 9°71617 | 31 | 10°28383 | 9°94799 | 35 | 31 |
| 30 | 9°6441 | 25 | 9°71648 | 31 | 10°28352 | 9°94793 | 36 | 30 |
| ' | Cosine. | | Cotang. | Tangent. | | Sine. | | ' |

[62 degrees.]

[27 degrees.]

| ' | Sine. | Diff. | Tangent. | Diff. | Cotang. | Cosine. | D. | ' |
|----|---------|-------|----------|----------|----------|---------|----|----|
| 30 | 9°6641 | 24 | 9°71648 | 31 | 10°28352 | 9°94793 | 30 | 30 |
| 29 | 9°6646 | 24 | 9°71679 | 30 | 10°28321 | 9°94786 | 29 | 29 |
| 28 | 9°6649 | 24 | 9°71709 | 31 | 10°28291 | 9°94780 | 28 | 28 |
| 27 | 9°6653 | 24 | 9°71740 | 31 | 10°28260 | 9°94773 | 27 | 27 |
| 26 | 9°6657 | 25 | 9°71771 | 31 | 10°28229 | 9°94767 | 26 | 26 |
| 25 | 9°6656 | 24 | 9°71802 | 31 | 10°28198 | 9°94760 | 25 | 25 |
| 24 | 9°6658 | 24 | 9°71833 | 30 | 10°28167 | 9°94753 | 24 | 24 |
| 23 | 9°6660 | 24 | 9°71863 | 31 | 10°28137 | 9°94747 | 23 | 23 |
| 22 | 9°6663 | 24 | 9°71894 | 31 | 10°28106 | 9°94740 | 22 | 22 |
| 21 | 9°6665 | 24 | 9°71925 | 30 | 10°28075 | 9°94734 | 21 | 21 |
| 20 | 9°6668 | 24 | 9°71956 | 31 | 10°28045 | 9°94727 | 20 | 20 |
| 19 | 9°6670 | 25 | 9°71986 | 31 | 10°28014 | 9°94720 | 19 | 19 |
| 18 | 9°6671 | 24 | 9°72017 | 31 | 10°27983 | 9°94714 | 18 | 18 |
| 17 | 9°6675 | 24 | 9°72048 | 30 | 10°27952 | 9°94707 | 17 | 17 |
| 16 | 9°6677 | 24 | 9°72078 | 31 | 10°27922 | 9°94700 | 16 | 16 |
| 15 | 9°6680 | 24 | 9°72109 | 31 | 10°27891 | 9°94694 | 15 | 15 |
| 14 | 9°6682 | 24 | 9°72140 | 30 | 10°27860 | 9°94687 | 14 | 14 |
| 13 | 9°6685 | 24 | 9°72170 | 31 | 10°27830 | 9°94680 | 13 | 13 |
| 12 | 9°6687 | 24 | 9°72201 | 30 | 10°27799 | 9°94674 | 12 | 12 |
| 11 | 9°6689 | 23 | 9°72232 | 31 | 10°27769 | 9°94667 | 11 | 11 |
| 10 | 9°6692 | 24 | 9°72263 | 31 | 10°27738 | 9°94660 | 10 | 10 |
| 9 | 9°6694 | 24 | 9°72293 | 30 | 10°27707 | 9°94654 | 9 | 9 |
| 8 | 9°6697 | 24 | 9°72323 | 31 | 10°27677 | 9°94647 | 8 | 8 |
| 7 | 9°6699 | 24 | 9°72354 | 30 | 10°27646 | 9°94640 | 7 | 7 |
| 6 | 9°6701 | 24 | 9°72384 | 31 | 10°27616 | 9°94634 | 6 | 6 |
| 5 | 9°6704 | 24 | 9°72415 | 30 | 10°27585 | 9°94627 | 5 | 5 |
| 4 | 9°6706 | 24 | 9°72445 | 31 | 10°27555 | 9°94620 | 4 | 4 |
| 3 | 9°6709 | 23 | 9°72476 | 31 | 10°27524 | 9°94614 | 3 | 3 |
| 2 | 9°6711 | 24 | 9°72506 | 30 | 10°27494 | 9°94607 | 2 | 2 |
| 1 | 9°6713 | 24 | 9°72537 | 31 | 10°27463 | 9°94600 | 1 | 1 |
| 0 | 9°6716 | 24 | 9°72567 | 30 | 10°27433 | 9°94593 | 0 | 0 |
| ' | Cosine. | | Cotang. | Tangent. | | Sine. | | ' |

[62 degrees.]

[28 degrees.]

| ' | Sine. | Diff. | Tangent. | Diff. | Cotang. | Cosine. | D. | ' |
|----|---------|-------|----------|-------|----------|---------|----|----|
| 30 | 9.67866 | 24 | 9.73476 | 31 | 10.26524 | 9.94390 | 7 | 30 |
| 31 | 9.67890 | 23 | 9.73507 | 30 | 10.26493 | 9.94383 | 7 | 29 |
| 32 | 9.67913 | 23 | 9.73537 | 30 | 10.26463 | 9.94376 | 7 | 28 |
| 33 | 9.67936 | 23 | 9.73567 | 30 | 10.26433 | 9.94369 | 7 | 27 |
| 34 | 9.67959 | 23 | 9.73597 | 30 | 10.26403 | 9.94362 | 7 | 26 |
| 35 | 9.67982 | 24 | 9.73627 | 30 | 10.26373 | 9.94355 | 6 | 25 |
| 36 | 9.68006 | 23 | 9.73657 | 30 | 10.26343 | 9.94349 | 7 | 24 |
| 37 | 9.68029 | 23 | 9.73687 | 30 | 10.26313 | 9.94342 | 7 | 23 |
| 38 | 9.68052 | 23 | 9.73717 | 30 | 10.26283 | 9.94335 | 7 | 22 |
| 39 | 9.68075 | 23 | 9.73747 | 30 | 10.26253 | 9.94328 | 7 | 21 |
| 40 | 9.68098 | 23 | 9.73777 | 30 | 10.26223 | 9.94321 | 7 | 20 |
| 41 | 9.68121 | 23 | 9.73807 | 30 | 10.26193 | 9.94314 | 7 | 19 |
| 42 | 9.68144 | 23 | 9.73837 | 30 | 10.26163 | 9.94307 | 7 | 18 |
| 43 | 9.68167 | 23 | 9.73867 | 30 | 10.26133 | 9.94300 | 7 | 17 |
| 44 | 9.68190 | 23 | 9.73897 | 30 | 10.26103 | 9.94293 | 7 | 16 |
| 45 | 9.68213 | 24 | 9.73927 | 30 | 10.26073 | 9.94286 | 7 | 15 |
| 46 | 9.68237 | 23 | 9.73957 | 30 | 10.26043 | 9.94279 | 6 | 14 |
| 47 | 9.68260 | 23 | 9.73987 | 30 | 10.26013 | 9.94273 | 7 | 13 |
| 48 | 9.68283 | 22 | 9.74017 | 30 | 10.25983 | 9.94266 | 7 | 12 |
| 49 | 9.68305 | 23 | 9.74047 | 30 | 10.25953 | 9.94259 | 7 | 11 |
| 50 | 9.68328 | 23 | 9.74077 | 30 | 10.25923 | 9.94252 | 7 | 10 |
| 51 | 9.68351 | 23 | 9.74107 | 30 | 10.25893 | 9.94245 | 7 | 9 |
| 52 | 9.68374 | 23 | 9.74137 | 29 | 10.25863 | 9.94238 | 7 | 8 |
| 53 | 9.68397 | 23 | 9.74166 | 30 | 10.25834 | 9.94231 | 7 | 7 |
| 54 | 9.68420 | 23 | 9.74196 | 30 | 10.25804 | 9.94224 | 7 | 6 |
| 55 | 9.68443 | 23 | 9.74226 | 30 | 10.25774 | 9.94217 | 7 | 5 |
| 56 | 9.68466 | 23 | 9.74256 | 30 | 10.25744 | 9.94210 | 7 | 4 |
| 57 | 9.68489 | 23 | 9.74286 | 30 | 10.25714 | 9.94203 | 7 | 3 |
| 58 | 9.68512 | 22 | 9.74316 | 29 | 10.25684 | 9.94196 | 7 | 2 |
| 59 | 9.68534 | 23 | 9.74345 | 30 | 10.25655 | 9.94189 | 7 | 1 |
| 60 | 9.68557 | 23 | 9.74375 | 30 | 10.25625 | 9.94182 | 7 | 0 |
| ' | Cosine. | | Cotang. | | Tangent. | Sine. | | ' |

[61 degrees.]

[28 degrees.]

| ' | Sine. | Diff. | Tangent. | Diff. | Cotang. | Cosine. | D. | ' |
|----|---------|-------|----------|-------|----------|---------|----|----|
| 0 | 9.67161 | 24 | 9.72567 | 31 | 10.27433 | 9.94593 | 6 | 60 |
| 1 | 9.67185 | 23 | 9.72598 | 30 | 10.27402 | 9.94587 | 7 | 59 |
| 2 | 9.67208 | 24 | 9.72628 | 31 | 10.27372 | 9.94580 | 7 | 58 |
| 3 | 9.67232 | 24 | 9.72659 | 30 | 10.27341 | 9.94573 | 7 | 57 |
| 4 | 9.67256 | 24 | 9.72689 | 31 | 10.27311 | 9.94567 | 6 | 56 |
| 5 | 9.67280 | 23 | 9.72720 | 30 | 10.27280 | 9.94560 | 7 | 55 |
| 6 | 9.67303 | 24 | 9.72750 | 31 | 10.27250 | 9.94553 | 7 | 54 |
| 7 | 9.67327 | 23 | 9.72780 | 30 | 10.27220 | 9.94546 | 7 | 53 |
| 8 | 9.67350 | 24 | 9.72811 | 31 | 10.27189 | 9.94540 | 6 | 52 |
| 9 | 9.67374 | 24 | 9.72841 | 30 | 10.27159 | 9.94533 | 7 | 51 |
| 10 | 9.67398 | 23 | 9.72872 | 31 | 10.27128 | 9.94526 | 7 | 50 |
| 11 | 9.67421 | 24 | 9.72902 | 30 | 10.27098 | 9.94519 | 7 | 49 |
| 12 | 9.67445 | 23 | 9.72932 | 31 | 10.27068 | 9.94513 | 6 | 48 |
| 13 | 9.67468 | 24 | 9.72963 | 30 | 10.27037 | 9.94506 | 7 | 47 |
| 14 | 9.67492 | 24 | 9.72993 | 31 | 10.27007 | 9.94499 | 7 | 46 |
| 15 | 9.67515 | 24 | 9.73023 | 30 | 10.26977 | 9.94492 | 7 | 45 |
| 16 | 9.67539 | 23 | 9.73054 | 31 | 10.26946 | 9.94485 | 6 | 44 |
| 17 | 9.67562 | 24 | 9.73084 | 30 | 10.26916 | 9.94479 | 7 | 43 |
| 18 | 9.67586 | 23 | 9.73114 | 31 | 10.26886 | 9.94472 | 7 | 42 |
| 19 | 9.67609 | 24 | 9.73144 | 30 | 10.26856 | 9.94465 | 7 | 41 |
| 20 | 9.67633 | 23 | 9.73175 | 31 | 10.26825 | 9.94458 | 7 | 40 |
| 21 | 9.67656 | 24 | 9.73205 | 30 | 10.26795 | 9.94451 | 6 | 39 |
| 22 | 9.67680 | 23 | 9.73235 | 31 | 10.26765 | 9.94445 | 7 | 38 |
| 23 | 9.67703 | 24 | 9.73265 | 30 | 10.26735 | 9.94438 | 7 | 37 |
| 24 | 9.67726 | 23 | 9.73295 | 31 | 10.26705 | 9.94431 | 7 | 36 |
| 25 | 9.67750 | 24 | 9.73326 | 30 | 10.26674 | 9.94424 | 7 | 35 |
| 26 | 9.67773 | 23 | 9.73356 | 31 | 10.26644 | 9.94417 | 7 | 34 |
| 27 | 9.67796 | 24 | 9.73386 | 30 | 10.26614 | 9.94410 | 7 | 33 |
| 28 | 9.67820 | 23 | 9.73416 | 31 | 10.26584 | 9.94404 | 6 | 32 |
| 29 | 9.67843 | 24 | 9.73446 | 30 | 10.26554 | 9.94397 | 7 | 31 |
| 30 | 9.67866 | 23 | 9.73476 | 31 | 10.26524 | 9.94390 | 7 | 30 |
| ' | Cosine. | | Cotang. | | Tangent. | Sine. | | ' |

[61 degrees.]

[29 degrees.]

| ' | Sine. | Diff. | Tangent. | Diff. | Cotang. | Cosine. | D. | ' |
|----|---------|-------|----------|-------|----------|---------|----|----|
| 0 | 9.68557 | 23 | 9.74375 | 30 | 10.25625 | 9.94182 | 7 | 60 |
| 1 | 9.68580 | 23 | 9.74405 | 30 | 10.25595 | 9.94175 | 7 | 59 |
| 2 | 9.68603 | 22 | 9.74435 | 30 | 10.25565 | 9.94168 | 7 | 58 |
| 3 | 9.68625 | 23 | 9.74465 | 29 | 10.25535 | 9.94161 | 7 | 57 |
| 4 | 9.68648 | 23 | 9.74494 | 30 | 10.25506 | 9.94154 | 7 | 56 |
| 5 | 9.68671 | 23 | 9.74524 | 30 | 10.25476 | 9.94147 | 7 | 55 |
| 6 | 9.68694 | 22 | 9.74554 | 29 | 10.25446 | 9.94140 | 7 | 54 |
| 7 | 9.68716 | 22 | 9.74583 | 30 | 10.25417 | 9.94133 | 7 | 53 |
| 8 | 9.68739 | 23 | 9.74613 | 30 | 10.25387 | 9.94126 | 7 | 52 |
| 9 | 9.68762 | 22 | 9.74643 | 30 | 10.25357 | 9.94119 | 7 | 51 |
| 10 | 9.68784 | 23 | 9.74673 | 29 | 10.25327 | 9.94112 | 7 | 50 |
| 11 | 9.68807 | 22 | 9.74702 | 30 | 10.25298 | 9.94105 | 7 | 49 |
| 12 | 9.68829 | 23 | 9.74732 | 30 | 10.25268 | 9.94098 | 7 | 48 |
| 13 | 9.68852 | 23 | 9.74762 | 29 | 10.25238 | 9.94090 | 7 | 47 |
| 14 | 9.68875 | 22 | 9.74791 | 30 | 10.25209 | 9.94083 | 7 | 46 |
| 15 | 9.68897 | 23 | 9.74821 | 30 | 10.25179 | 9.94076 | 7 | 45 |
| 16 | 9.68920 | 22 | 9.74851 | 29 | 10.25149 | 9.94069 | 7 | 44 |
| 17 | 9.68942 | 23 | 9.74880 | 30 | 10.25120 | 9.94062 | 7 | 43 |
| 18 | 9.68965 | 22 | 9.74910 | 29 | 10.25090 | 9.94055 | 7 | 42 |
| 19 | 9.68987 | 23 | 9.74939 | 30 | 10.25061 | 9.94048 | 7 | 41 |
| 20 | 9.69010 | 22 | 9.74969 | 29 | 10.25031 | 9.94041 | 7 | 40 |
| 21 | 9.69032 | 23 | 9.74998 | 30 | 10.25002 | 9.94034 | 7 | 39 |
| 22 | 9.69055 | 22 | 9.75028 | 30 | 10.24972 | 9.94027 | 7 | 38 |
| 23 | 9.69077 | 23 | 9.75058 | 29 | 10.24942 | 9.94020 | 8 | 37 |
| 24 | 9.69100 | 22 | 9.75087 | 30 | 10.24913 | 9.94012 | 7 | 36 |
| 25 | 9.69122 | 22 | 9.75117 | 29 | 10.24883 | 9.94005 | 7 | 35 |
| 26 | 9.69144 | 23 | 9.75146 | 30 | 10.24854 | 9.93998 | 7 | 34 |
| 27 | 9.69167 | 22 | 9.75176 | 29 | 10.24824 | 9.93991 | 7 | 33 |
| 28 | 9.69189 | 23 | 9.75205 | 30 | 10.24795 | 9.93984 | 7 | 32 |
| 29 | 9.69212 | 22 | 9.75235 | 29 | 10.24765 | 9.93977 | 7 | 31 |
| 30 | 9.69234 | 22 | 9.75264 | | 10.24736 | 9.93970 | 7 | 30 |
| ' | Cosine. | | Cotang. | | Tangent. | Sine. | | ' |

[60 degrees.]

[29 degrees.]

| ' | Sine. | Diff. | Tangent. | Diff. | Cotang. | Cosine. | D. | ' |
|----|---------|-------|----------|-------|----------|---------|----|----|
| 30 | 9.69256 | 22 | 9.75294 | 30 | 10.24736 | 9.93970 | 7 | 30 |
| 31 | 9.69279 | 23 | 9.75323 | 29 | 10.24706 | 9.93963 | 7 | 29 |
| 32 | 9.69299 | 22 | 9.75353 | 30 | 10.24677 | 9.93955 | 7 | 28 |
| 33 | 9.69301 | 22 | 9.75383 | 29 | 10.24647 | 9.93948 | 7 | 27 |
| 34 | 9.69323 | 22 | 9.75412 | 29 | 10.24618 | 9.93941 | 7 | 26 |
| 35 | 9.69345 | 23 | 9.75441 | 30 | 10.24589 | 9.93934 | 7 | 25 |
| 36 | 9.69368 | 22 | 9.75470 | 29 | 10.24559 | 9.93927 | 7 | 24 |
| 37 | 9.69390 | 22 | 9.75500 | 30 | 10.24530 | 9.93920 | 8 | 23 |
| 38 | 9.69412 | 22 | 9.75529 | 29 | 10.24500 | 9.93912 | 7 | 22 |
| 39 | 9.69434 | 22 | 9.75559 | 29 | 10.24471 | 9.93905 | 7 | 21 |
| 40 | 9.69456 | 23 | 9.75588 | 30 | 10.24442 | 9.93898 | 7 | 20 |
| 41 | 9.69479 | 22 | 9.75617 | 29 | 10.24412 | 9.93891 | 7 | 19 |
| 42 | 9.69501 | 22 | 9.75647 | 30 | 10.24383 | 9.93884 | 8 | 18 |
| 43 | 9.69523 | 22 | 9.75676 | 29 | 10.24353 | 9.93876 | 7 | 17 |
| 44 | 9.69545 | 22 | 9.75705 | 29 | 10.24324 | 9.93869 | 7 | 16 |
| 45 | 9.69567 | 22 | 9.75735 | 30 | 10.24295 | 9.93862 | 7 | 15 |
| 46 | 9.69589 | 22 | 9.75764 | 29 | 10.24265 | 9.93855 | 7 | 14 |
| 47 | 9.69611 | 22 | 9.75793 | 29 | 10.24236 | 9.93847 | 7 | 13 |
| 48 | 9.69633 | 22 | 9.75822 | 30 | 10.24207 | 9.93840 | 7 | 12 |
| 49 | 9.69655 | 22 | 9.75852 | 29 | 10.24178 | 9.93833 | 7 | 11 |
| 50 | 9.69677 | 22 | 9.75881 | 29 | 10.24148 | 9.93826 | 7 | 10 |
| 51 | 9.69699 | 22 | 9.75910 | 29 | 10.24119 | 9.93819 | 8 | 9 |
| 52 | 9.69721 | 22 | 9.75939 | 30 | 10.24090 | 9.93811 | 7 | 8 |
| 53 | 9.69743 | 22 | 9.75968 | 29 | 10.24061 | 9.93804 | 7 | 7 |
| 54 | 9.69765 | 22 | 9.75997 | 29 | 10.24031 | 9.93797 | 8 | 6 |
| 55 | 9.69787 | 22 | 9.76026 | 30 | 10.24002 | 9.93789 | 7 | 5 |
| 56 | 9.69809 | 22 | 9.76055 | 29 | 10.23973 | 9.93782 | 7 | 4 |
| 57 | 9.69831 | 22 | 9.76084 | 29 | 10.23944 | 9.93775 | 7 | 3 |
| 58 | 9.69853 | 22 | 9.76113 | 30 | 10.23914 | 9.93768 | 7 | 2 |
| 59 | 9.69875 | 22 | 9.76142 | 29 | 10.23885 | 9.93760 | 7 | 1 |
| 60 | 9.69897 | 22 | 9.76171 | 29 | 10.23856 | 9.93753 | 7 | 0 |
| ' | Cosine. | | Cotang. | | Tangent. | Sine. | | ' |

[60 degrees.]

[30 degrees.]

| ' | Sine. | Diff. | Tangent. | Diff. | Colang. | Costine. | D. | ' |
|----|----------|---------|----------|-------|----------|----------|----|----|
| 30 | 9.70547 | 21 | 9.77015 | 29 | 10.22085 | 9.93532 | 7 | 30 |
| 31 | 9.70568 | 22 | 9.77044 | 29 | 10.22096 | 9.93525 | 8 | 29 |
| 32 | 9.70590 | 21 | 9.77073 | 28 | 10.22097 | 9.93517 | 7 | 28 |
| 33 | 9.70611 | 22 | 9.77101 | 29 | 10.22099 | 9.93510 | 8 | 27 |
| 34 | 9.70633 | 21 | 9.77130 | 29 | 10.22087 | 9.93502 | 7 | 26 |
| 35 | 9.70654 | 21 | 9.77159 | 29 | 10.22084 | 9.93495 | 8 | 25 |
| 36 | 9.70675 | 22 | 9.77188 | 29 | 10.22082 | 9.93487 | 7 | 24 |
| 37 | 9.70697 | 21 | 9.77217 | 29 | 10.22078 | 9.93480 | 8 | 23 |
| 38 | 9.70718 | 21 | 9.77246 | 28 | 10.22075 | 9.93472 | 7 | 22 |
| 39 | 9.70739 | 22 | 9.77274 | 29 | 10.22072 | 9.93465 | 8 | 21 |
| 40 | 9.70761 | 21 | 9.77303 | 29 | 10.22068 | 9.93457 | 7 | 19 |
| 41 | 9.70782 | 21 | 9.77332 | 29 | 10.22066 | 9.93450 | 8 | 18 |
| 42 | 9.70803 | 21 | 9.77361 | 29 | 10.22063 | 9.93442 | 7 | 17 |
| 43 | 9.70824 | 22 | 9.77390 | 28 | 10.22060 | 9.93435 | 8 | 16 |
| 44 | 9.70846 | 21 | 9.77418 | 29 | 10.22058 | 9.93427 | 7 | 15 |
| 45 | 9.70867 | 21 | 9.77447 | 29 | 10.22055 | 9.93420 | 8 | 14 |
| 46 | 9.70888 | 21 | 9.77476 | 29 | 10.22052 | 9.93412 | 7 | 13 |
| 47 | 9.70909 | 22 | 9.77505 | 28 | 10.22049 | 9.93405 | 8 | 12 |
| 48 | 9.70931 | 21 | 9.77533 | 29 | 10.22047 | 9.93397 | 7 | 11 |
| 49 | 9.70952 | 21 | 9.77562 | 29 | 10.22043 | 9.93390 | 8 | 10 |
| 50 | 9.70973 | 21 | 9.77591 | 28 | 10.22040 | 9.93382 | 7 | 9 |
| 51 | 9.70994 | 21 | 9.77619 | 29 | 10.22038 | 9.93375 | 8 | 8 |
| 52 | 9.71015 | 21 | 9.77648 | 29 | 10.22035 | 9.93367 | 7 | 7 |
| 53 | 9.71036 | 22 | 9.77677 | 29 | 10.22032 | 9.93360 | 8 | 6 |
| 54 | 9.71058 | 21 | 9.77706 | 28 | 10.22029 | 9.93352 | 7 | 5 |
| 55 | 9.71079 | 21 | 9.77734 | 29 | 10.22026 | 9.93344 | 8 | 4 |
| 56 | 9.71100 | 21 | 9.77763 | 28 | 10.22023 | 9.93337 | 7 | 3 |
| 57 | 9.71121 | 21 | 9.77791 | 29 | 10.22020 | 9.93329 | 8 | 2 |
| 58 | 9.71142 | 21 | 9.77820 | 29 | 10.22018 | 9.93322 | 7 | 1 |
| 59 | 9.71163 | 21 | 9.77849 | 28 | 10.22015 | 9.93314 | 8 | 0 |
| 60 | 9.71184 | 21 | 9.77877 | 28 | 10.22012 | 9.93307 | 7 | 0 |
| ' | Costine. | Colang. | Tangent. | Sine. | | | | |

[59 degrees.]

[30 degrees.]

| ' | Sine. | Diff. | Tangent. | Diff. | Colang. | Costine. | D. | ' |
|----|----------|---------|----------|-------|----------|----------|----|----|
| 0 | 9.69897 | 22 | 9.76144 | 29 | 10.23856 | 9.93753 | 7 | 60 |
| 1 | 9.69919 | 22 | 9.76173 | 29 | 10.23827 | 9.93746 | 8 | 59 |
| 2 | 9.69941 | 22 | 9.76202 | 29 | 10.23798 | 9.93738 | 7 | 58 |
| 3 | 9.69963 | 21 | 9.76231 | 29 | 10.23769 | 9.93731 | 7 | 57 |
| 4 | 9.69984 | 22 | 9.76261 | 30 | 10.23739 | 9.93724 | 7 | 56 |
| 5 | 9.70006 | 22 | 9.76290 | 29 | 10.23710 | 9.93717 | 8 | 55 |
| 6 | 9.70028 | 22 | 9.76319 | 29 | 10.23681 | 9.93709 | 7 | 54 |
| 7 | 9.70050 | 22 | 9.76348 | 29 | 10.23652 | 9.93702 | 7 | 53 |
| 8 | 9.70072 | 21 | 9.76377 | 29 | 10.23623 | 9.93695 | 8 | 52 |
| 9 | 9.70093 | 22 | 9.76406 | 29 | 10.23594 | 9.93687 | 7 | 51 |
| 10 | 9.70115 | 22 | 9.76435 | 29 | 10.23565 | 9.93680 | 7 | 50 |
| 11 | 9.70137 | 22 | 9.76464 | 29 | 10.23536 | 9.93673 | 8 | 49 |
| 12 | 9.70159 | 21 | 9.76493 | 29 | 10.23507 | 9.93665 | 7 | 48 |
| 13 | 9.70180 | 22 | 9.76522 | 29 | 10.23478 | 9.93658 | 7 | 47 |
| 14 | 9.70202 | 22 | 9.76551 | 29 | 10.23449 | 9.93650 | 7 | 46 |
| 15 | 9.70224 | 21 | 9.76580 | 29 | 10.23420 | 9.93643 | 7 | 45 |
| 16 | 9.70245 | 22 | 9.76609 | 30 | 10.23391 | 9.93636 | 8 | 44 |
| 17 | 9.70267 | 21 | 9.76639 | 29 | 10.23361 | 9.93628 | 7 | 43 |
| 18 | 9.70288 | 22 | 9.76668 | 29 | 10.23332 | 9.93621 | 7 | 42 |
| 19 | 9.70310 | 22 | 9.76697 | 28 | 10.23303 | 9.93614 | 8 | 41 |
| 20 | 9.70332 | 21 | 9.76725 | 29 | 10.23275 | 9.93606 | 7 | 40 |
| 21 | 9.70353 | 22 | 9.76754 | 29 | 10.23246 | 9.93599 | 8 | 39 |
| 22 | 9.70375 | 21 | 9.76783 | 29 | 10.23217 | 9.93591 | 7 | 38 |
| 23 | 9.70396 | 22 | 9.76812 | 29 | 10.23188 | 9.93584 | 7 | 37 |
| 24 | 9.70418 | 21 | 9.76841 | 29 | 10.23159 | 9.93577 | 8 | 36 |
| 25 | 9.70439 | 22 | 9.76870 | 29 | 10.23130 | 9.93569 | 7 | 35 |
| 26 | 9.70461 | 21 | 9.76899 | 29 | 10.23101 | 9.93562 | 8 | 34 |
| 27 | 9.70482 | 22 | 9.76928 | 29 | 10.23072 | 9.93554 | 7 | 33 |
| 28 | 9.70504 | 21 | 9.76957 | 29 | 10.23043 | 9.93547 | 8 | 32 |
| 29 | 9.70525 | 22 | 9.76986 | 29 | 10.23014 | 9.93539 | 7 | 31 |
| 30 | 9.70547 | 22 | 9.77015 | 29 | 10.22985 | 9.93532 | 7 | 30 |
| ' | Costine. | Colang. | Tangent. | Sine. | | | | |

[59 degrees.]

[31 degrees.]

| ' | Sine. | Diff. | Tangent. | Diff. | Cotang. | Cosine. | D. | ' |
|----|---------|---------|----------|-------|----------|---------|----|----|
| 0 | 9'71184 | 21 | 9'77877 | 29 | 10'22123 | 9'93307 | 8 | 60 |
| 1 | 9'71205 | 21 | 9'77906 | 29 | 10'22094 | 9'93299 | 8 | 59 |
| 2 | 9'71226 | 21 | 9'77935 | 29 | 10'22065 | 9'93291 | 8 | 58 |
| 3 | 9'71247 | 21 | 9'77963 | 29 | 10'22037 | 9'93284 | 7 | 57 |
| 4 | 9'71268 | 21 | 9'77992 | 28 | 10'22008 | 9'93276 | 7 | 56 |
| 5 | 9'71289 | 21 | 9'78020 | 29 | 10'21980 | 9'93269 | 7 | 55 |
| 6 | 9'71310 | 21 | 9'78049 | 28 | 10'21951 | 9'93261 | 8 | 54 |
| 7 | 9'71331 | 21 | 9'78077 | 29 | 10'21923 | 9'93253 | 8 | 53 |
| 8 | 9'71352 | 21 | 9'78106 | 29 | 10'21894 | 9'93246 | 7 | 52 |
| 9 | 9'71373 | 20 | 9'78135 | 28 | 10'21865 | 9'93238 | 8 | 51 |
| 10 | 9'71393 | 21 | 9'78163 | 29 | 10'21837 | 9'93230 | 8 | 50 |
| 11 | 9'71414 | 21 | 9'78192 | 28 | 10'21808 | 9'93223 | 7 | 49 |
| 12 | 9'71435 | 21 | 9'78220 | 29 | 10'21780 | 9'93215 | 8 | 48 |
| 13 | 9'71456 | 21 | 9'78249 | 28 | 10'21751 | 9'93207 | 7 | 47 |
| 14 | 9'71477 | 21 | 9'78277 | 29 | 10'21723 | 9'93200 | 8 | 46 |
| 15 | 9'71498 | 21 | 9'78306 | 28 | 10'21694 | 9'93192 | 8 | 45 |
| 16 | 9'71519 | 20 | 9'78334 | 29 | 10'21666 | 9'93184 | 8 | 44 |
| 17 | 9'71539 | 21 | 9'78363 | 28 | 10'21637 | 9'93177 | 7 | 43 |
| 18 | 9'71560 | 21 | 9'78391 | 28 | 10'21609 | 9'93169 | 8 | 42 |
| 19 | 9'71581 | 21 | 9'78419 | 29 | 10'21581 | 9'93161 | 7 | 41 |
| 20 | 9'71602 | 20 | 9'78448 | 28 | 10'21552 | 9'93154 | 8 | 40 |
| 21 | 9'71622 | 21 | 9'78476 | 29 | 10'21524 | 9'93146 | 8 | 39 |
| 22 | 9'71643 | 21 | 9'78505 | 28 | 10'21495 | 9'93138 | 8 | 38 |
| 23 | 9'71664 | 21 | 9'78533 | 29 | 10'21467 | 9'93131 | 7 | 37 |
| 24 | 9'71685 | 20 | 9'78562 | 28 | 10'21438 | 9'93123 | 8 | 36 |
| 25 | 9'71705 | 21 | 9'78590 | 28 | 10'21410 | 9'93115 | 7 | 35 |
| 26 | 9'71726 | 21 | 9'78618 | 29 | 10'21382 | 9'93108 | 8 | 34 |
| 27 | 9'71747 | 20 | 9'78647 | 28 | 10'21353 | 9'93100 | 8 | 33 |
| 28 | 9'71767 | 21 | 9'78675 | 29 | 10'21325 | 9'93092 | 8 | 32 |
| 29 | 9'71788 | 21 | 9'78704 | 28 | 10'21296 | 9'93084 | 7 | 31 |
| 30 | 9'71809 | | 9'78732 | 28 | 10'21268 | 9'93077 | 7 | 30 |
| ' | Cosine. | Cotang. | Tangent. | Sine. | | | | |

[58 degrees.]

[31 degrees.]

| ' | Sine. | Diff. | Tangent. | Diff. | Cotang. | Cosine. | D. | ' |
|----|---------|---------|----------|-------|----------|---------|----|----|
| 30 | 9'71809 | 20 | 9'78732 | 28 | 10'21268 | 9'93077 | 8 | 30 |
| 31 | 9'71829 | 21 | 9'78760 | 29 | 10'21240 | 9'93069 | 8 | 29 |
| 32 | 9'71850 | 20 | 9'78789 | 28 | 10'21211 | 9'93061 | 8 | 28 |
| 33 | 9'71870 | 21 | 9'78817 | 29 | 10'21183 | 9'93053 | 7 | 27 |
| 34 | 9'71891 | 20 | 9'78845 | 28 | 10'21155 | 9'93046 | 8 | 26 |
| 35 | 9'71911 | 21 | 9'78874 | 29 | 10'21126 | 9'93038 | 8 | 25 |
| 36 | 9'71932 | 20 | 9'78902 | 28 | 10'21098 | 9'93030 | 8 | 24 |
| 37 | 9'71952 | 21 | 9'78930 | 29 | 10'21070 | 9'93022 | 8 | 23 |
| 38 | 9'71973 | 21 | 9'78959 | 28 | 10'21041 | 9'93014 | 8 | 22 |
| 39 | 9'71994 | 20 | 9'78987 | 29 | 10'21013 | 9'93007 | 7 | 21 |
| 40 | 9'72014 | 20 | 9'79015 | 28 | 10'20985 | 9'92999 | 8 | 20 |
| 41 | 9'72034 | 21 | 9'79043 | 29 | 10'20957 | 9'92991 | 8 | 19 |
| 42 | 9'72055 | 20 | 9'79072 | 28 | 10'20928 | 9'92983 | 8 | 18 |
| 43 | 9'72075 | 21 | 9'79100 | 29 | 10'20900 | 9'92976 | 7 | 17 |
| 44 | 9'72096 | 20 | 9'79128 | 28 | 10'20872 | 9'92968 | 8 | 16 |
| 45 | 9'72116 | 21 | 9'79156 | 29 | 10'20844 | 9'92960 | 8 | 15 |
| 46 | 9'72137 | 20 | 9'79185 | 28 | 10'20815 | 9'92952 | 8 | 14 |
| 47 | 9'72157 | 21 | 9'79213 | 29 | 10'20787 | 9'92944 | 8 | 13 |
| 48 | 9'72177 | 21 | 9'79241 | 28 | 10'20759 | 9'92936 | 7 | 12 |
| 49 | 9'72198 | 20 | 9'79269 | 29 | 10'20731 | 9'92929 | 8 | 11 |
| 50 | 9'72218 | 20 | 9'79297 | 28 | 10'20703 | 9'92921 | 8 | 10 |
| 51 | 9'72238 | 21 | 9'79326 | 29 | 10'20674 | 9'92913 | 8 | 9 |
| 52 | 9'72259 | 20 | 9'79354 | 28 | 10'20646 | 9'92905 | 8 | 8 |
| 53 | 9'72279 | 21 | 9'79382 | 29 | 10'20618 | 9'92897 | 7 | 7 |
| 54 | 9'72299 | 21 | 9'79410 | 28 | 10'20590 | 9'92889 | 8 | 6 |
| 55 | 9'72320 | 20 | 9'79438 | 29 | 10'20562 | 9'92881 | 8 | 5 |
| 56 | 9'72340 | 20 | 9'79466 | 28 | 10'20534 | 9'92874 | 7 | 4 |
| 57 | 9'72360 | 21 | 9'79495 | 29 | 10'20505 | 9'92866 | 8 | 3 |
| 58 | 9'72381 | 20 | 9'79523 | 28 | 10'20477 | 9'92858 | 8 | 2 |
| 59 | 9'72401 | 20 | 9'79551 | 28 | 10'20449 | 9'92850 | 8 | 1 |
| 60 | 9'72421 | | 9'79579 | 28 | 10'20421 | 9'92842 | 8 | 0 |
| ' | Cosine. | Cotang. | Tangent. | Sine. | | | | |

[58 degrees.]

[32 degrees.]

| ' | Sine. | Diff. | Tangent. | Diff. | Cotang. | Cosine. | D. | ' |
|----|---------|---------|----------|-------|----------|---------|----|----|
| 30 | 973022 | 19 | 980419 | 28 | 10.19581 | 9.92603 | 8 | 30 |
| 31 | 973041 | 20 | 980447 | 27 | 10.19553 | 9.92595 | 8 | 29 |
| 32 | 973061 | 20 | 980474 | 28 | 10.19526 | 9.92587 | 8 | 28 |
| 33 | 973081 | 20 | 980502 | 28 | 10.19498 | 9.92579 | 8 | 27 |
| 34 | 973101 | 20 | 980530 | 28 | 10.19470 | 9.92571 | 8 | 26 |
| 35 | 973121 | 19 | 980558 | 28 | 10.19442 | 9.92563 | 8 | 25 |
| 36 | 973140 | 20 | 980586 | 28 | 10.19414 | 9.92555 | 8 | 24 |
| 37 | 973160 | 20 | 980614 | 28 | 10.19386 | 9.92546 | 9 | 23 |
| 38 | 973180 | 20 | 980642 | 27 | 10.19358 | 9.92538 | 8 | 22 |
| 39 | 973200 | 19 | 980669 | 28 | 10.19331 | 9.92530 | 8 | 21 |
| 40 | 973219 | 20 | 980697 | 28 | 10.19303 | 9.92522 | 8 | 20 |
| 41 | 973239 | 20 | 980725 | 28 | 10.19275 | 9.92514 | 8 | 19 |
| 42 | 973259 | 19 | 980753 | 28 | 10.19247 | 9.92506 | 8 | 18 |
| 43 | 973278 | 20 | 980781 | 27 | 10.19219 | 9.92498 | 8 | 17 |
| 44 | 973298 | 20 | 980808 | 28 | 10.19192 | 9.92490 | 8 | 16 |
| 45 | 973318 | 19 | 980836 | 28 | 10.19164 | 9.92482 | 9 | 15 |
| 46 | 973337 | 20 | 980864 | 28 | 10.19136 | 9.92473 | 8 | 14 |
| 47 | 973357 | 20 | 980892 | 27 | 10.19108 | 9.92465 | 8 | 13 |
| 48 | 973377 | 19 | 980919 | 28 | 10.19081 | 9.92457 | 8 | 12 |
| 49 | 973396 | 20 | 980947 | 28 | 10.19053 | 9.92449 | 8 | 11 |
| 50 | 973416 | 19 | 980975 | 28 | 10.19025 | 9.92441 | 8 | 10 |
| 51 | 973435 | 20 | 981003 | 27 | 10.18997 | 9.92433 | 8 | 9 |
| 52 | 973455 | 19 | 981030 | 28 | 10.18970 | 9.92425 | 8 | 8 |
| 53 | 973474 | 20 | 981058 | 28 | 10.18942 | 9.92416 | 8 | 7 |
| 54 | 973494 | 19 | 981086 | 27 | 10.18914 | 9.92408 | 8 | 6 |
| 55 | 973513 | 20 | 981113 | 28 | 10.18887 | 9.92400 | 8 | 5 |
| 56 | 973533 | 19 | 981141 | 27 | 10.18859 | 9.92392 | 8 | 4 |
| 57 | 973552 | 20 | 981169 | 28 | 10.18831 | 9.92384 | 8 | 3 |
| 58 | 973572 | 19 | 981196 | 28 | 10.18804 | 9.92376 | 9 | 2 |
| 59 | 973591 | 20 | 981224 | 28 | 10.18776 | 9.92367 | 8 | 1 |
| 60 | 973611 | 20 | 981252 | 28 | 10.18748 | 9.92359 | 8 | 0 |
| ' | Cosine. | Cotang. | Tangent. | Sine. | | | | ' |

[57 degrees.]

[32 degrees.]

| ' | Sine. | Diff. | Tangent. | Diff. | Cotang. | Cosine. | D. | ' |
|----|---------|---------|----------|-------|----------|---------|----|----|
| 0 | 972421 | 20 | 979579 | 28 | 10.20421 | 9.92842 | 8 | 60 |
| 1 | 972441 | 20 | 979607 | 28 | 10.20393 | 9.92834 | 8 | 59 |
| 2 | 972461 | 21 | 979635 | 28 | 10.20365 | 9.92826 | 8 | 58 |
| 3 | 972482 | 20 | 979663 | 28 | 10.20337 | 9.92818 | 8 | 57 |
| 4 | 972502 | 20 | 979691 | 28 | 10.20309 | 9.92810 | 8 | 56 |
| 5 | 972522 | 20 | 979719 | 28 | 10.20281 | 9.92803 | 7 | 55 |
| 6 | 972542 | 20 | 979747 | 29 | 10.20253 | 9.92795 | 8 | 54 |
| 7 | 972562 | 20 | 979776 | 28 | 10.20224 | 9.92787 | 8 | 53 |
| 8 | 972582 | 20 | 979804 | 28 | 10.20196 | 9.92779 | 8 | 52 |
| 9 | 972602 | 20 | 979832 | 28 | 10.20168 | 9.92771 | 8 | 51 |
| 10 | 972622 | 21 | 979860 | 28 | 10.20140 | 9.92763 | 8 | 50 |
| 11 | 972643 | 20 | 979888 | 28 | 10.20112 | 9.92755 | 8 | 49 |
| 12 | 972663 | 20 | 979916 | 28 | 10.20084 | 9.92747 | 8 | 48 |
| 13 | 972683 | 20 | 979944 | 28 | 10.20056 | 9.92739 | 8 | 47 |
| 14 | 972703 | 20 | 979972 | 28 | 10.20028 | 9.92731 | 8 | 46 |
| 15 | 972723 | 20 | 980000 | 28 | 10.20000 | 9.92723 | 8 | 45 |
| 16 | 972743 | 20 | 980028 | 28 | 10.19972 | 9.92715 | 8 | 44 |
| 17 | 972763 | 20 | 980056 | 28 | 10.19944 | 9.92707 | 8 | 43 |
| 18 | 972783 | 20 | 980084 | 28 | 10.19916 | 9.92699 | 8 | 42 |
| 19 | 972803 | 20 | 980112 | 28 | 10.19888 | 9.92691 | 8 | 41 |
| 20 | 972823 | 20 | 980140 | 28 | 10.19860 | 9.92683 | 8 | 40 |
| 21 | 972843 | 20 | 980168 | 28 | 10.19832 | 9.92675 | 8 | 39 |
| 22 | 972863 | 20 | 980195 | 27 | 10.19805 | 9.92667 | 8 | 38 |
| 23 | 972883 | 20 | 980223 | 28 | 10.19777 | 9.92659 | 8 | 37 |
| 24 | 972902 | 19 | 980251 | 28 | 10.19749 | 9.92651 | 8 | 36 |
| 25 | 972922 | 20 | 980279 | 28 | 10.19721 | 9.92643 | 8 | 35 |
| 26 | 972942 | 20 | 980307 | 28 | 10.19693 | 9.92635 | 8 | 34 |
| 27 | 972962 | 20 | 980335 | 28 | 10.19665 | 9.92627 | 8 | 33 |
| 28 | 972982 | 20 | 980363 | 28 | 10.19637 | 9.92619 | 8 | 32 |
| 29 | 973002 | 20 | 980391 | 28 | 10.19609 | 9.92611 | 8 | 31 |
| 30 | 973022 | 20 | 980419 | 28 | 10.19581 | 9.92603 | 8 | 30 |
| ' | Cosine. | Cotang. | Tangent. | Sine. | | | | ' |

[57 degrees.]

[33 degrees.]

| ' | Sine. | Diff. | Tangent. | Diff. | Cotang. | Cosine. | D. | ' |
|----|---------|-------|----------|-------|----------|---------|----|----|
| 30 | 9.74189 | 19 | 9.82078 | 28 | 10.17922 | 9.92111 | 9 | 30 |
| 31 | 9.74208 | 19 | 9.82106 | 27 | 10.17894 | 9.92102 | 8 | 29 |
| 32 | 9.74227 | 19 | 9.82133 | 28 | 10.17867 | 9.92094 | 8 | 28 |
| 33 | 9.74246 | 19 | 9.82161 | 27 | 10.17839 | 9.92086 | 9 | 27 |
| 34 | 9.74265 | 19 | 9.82188 | 27 | 10.17812 | 9.92077 | 8 | 26 |
| 35 | 9.74284 | 19 | 9.82215 | 28 | 10.17785 | 9.92069 | 8 | 25 |
| 36 | 9.74303 | 19 | 9.82243 | 27 | 10.17757 | 9.92060 | 9 | 24 |
| 37 | 9.74322 | 19 | 9.82270 | 28 | 10.17730 | 9.92052 | 8 | 23 |
| 38 | 9.74341 | 19 | 9.82298 | 27 | 10.17702 | 9.92044 | 9 | 22 |
| 39 | 9.74360 | 19 | 9.82325 | 27 | 10.17675 | 9.92035 | 8 | 21 |
| 40 | 9.74379 | 19 | 9.82353 | 28 | 10.17648 | 9.92027 | 9 | 20 |
| 41 | 9.74398 | 19 | 9.82380 | 27 | 10.17620 | 9.92018 | 8 | 19 |
| 42 | 9.74417 | 19 | 9.82407 | 28 | 10.17593 | 9.92010 | 8 | 18 |
| 43 | 9.74436 | 19 | 9.82435 | 27 | 10.17565 | 9.92002 | 9 | 17 |
| 44 | 9.74455 | 19 | 9.82462 | 27 | 10.17538 | 9.91993 | 8 | 16 |
| 45 | 9.74474 | 19 | 9.82489 | 28 | 10.17511 | 9.91985 | 9 | 15 |
| 46 | 9.74493 | 19 | 9.82517 | 27 | 10.17483 | 9.91976 | 8 | 14 |
| 47 | 9.74512 | 19 | 9.82544 | 27 | 10.17456 | 9.91968 | 9 | 13 |
| 48 | 9.74531 | 18 | 9.82571 | 28 | 10.17429 | 9.91959 | 8 | 12 |
| 49 | 9.74549 | 19 | 9.82599 | 27 | 10.17401 | 9.91951 | 9 | 11 |
| 50 | 9.74568 | 19 | 9.82626 | 27 | 10.17374 | 9.91942 | 8 | 10 |
| 51 | 9.74587 | 19 | 9.82653 | 28 | 10.17347 | 9.91934 | 9 | 9 |
| 52 | 9.74606 | 19 | 9.82681 | 27 | 10.17319 | 9.91925 | 8 | 8 |
| 53 | 9.74625 | 19 | 9.82708 | 27 | 10.17292 | 9.91917 | 9 | 7 |
| 54 | 9.74644 | 18 | 9.82735 | 27 | 10.17265 | 9.91908 | 8 | 6 |
| 55 | 9.74662 | 19 | 9.82762 | 28 | 10.17238 | 9.91900 | 9 | 5 |
| 56 | 9.74681 | 19 | 9.82790 | 27 | 10.17210 | 9.91891 | 8 | 4 |
| 57 | 9.74700 | 19 | 9.82817 | 27 | 10.17183 | 9.91883 | 9 | 3 |
| 58 | 9.74719 | 18 | 9.82844 | 27 | 10.17156 | 9.91874 | 8 | 2 |
| 59 | 9.74737 | 19 | 9.82871 | 28 | 10.17129 | 9.91866 | 9 | 1 |
| 60 | 9.74756 | 19 | 9.82899 | 27 | 10.17101 | 9.91857 | 8 | 0 |
| ' | Cosine. | | Cotang. | | Tangent. | Sine. | | ' |

[56 degrees.]

[33 degrees.]

| ' | Sine. | Diff. | Tangent. | Diff. | Cotang. | Cosine. | D. | ' |
|----|---------|-------|----------|-------|----------|---------|----|----|
| 0 | 9.73611 | 19 | 9.81252 | 27 | 10.18748 | 9.92359 | 8 | 60 |
| 1 | 9.73630 | 20 | 9.81279 | 28 | 10.18721 | 9.92351 | 8 | 59 |
| 2 | 9.73650 | 19 | 9.81307 | 28 | 10.18693 | 9.92343 | 8 | 58 |
| 3 | 9.73669 | 19 | 9.81335 | 27 | 10.18665 | 9.92335 | 8 | 57 |
| 4 | 9.73689 | 20 | 9.81362 | 28 | 10.18638 | 9.92326 | 8 | 56 |
| 5 | 9.73708 | 19 | 9.81390 | 28 | 10.18610 | 9.92318 | 8 | 55 |
| 6 | 9.73727 | 19 | 9.81418 | 27 | 10.18582 | 9.92310 | 8 | 54 |
| 7 | 9.73747 | 20 | 9.81445 | 28 | 10.18555 | 9.92302 | 8 | 53 |
| 8 | 9.73766 | 19 | 9.81473 | 27 | 10.18527 | 9.92293 | 8 | 52 |
| 9 | 9.73785 | 20 | 9.81500 | 28 | 10.18500 | 9.92285 | 8 | 51 |
| 10 | 9.73805 | 19 | 9.81528 | 28 | 10.18472 | 9.92277 | 8 | 50 |
| 11 | 9.73824 | 19 | 9.81556 | 27 | 10.18444 | 9.92269 | 9 | 49 |
| 12 | 9.73843 | 20 | 9.81583 | 28 | 10.18417 | 9.92260 | 8 | 48 |
| 13 | 9.73863 | 19 | 9.81611 | 27 | 10.18389 | 9.92252 | 8 | 47 |
| 14 | 9.73882 | 19 | 9.81638 | 28 | 10.18362 | 9.92244 | 9 | 46 |
| 15 | 9.73901 | 20 | 9.81666 | 27 | 10.18334 | 9.92235 | 8 | 45 |
| 16 | 9.73921 | 19 | 9.81693 | 28 | 10.18307 | 9.92227 | 8 | 44 |
| 17 | 9.73940 | 19 | 9.81721 | 27 | 10.18279 | 9.92219 | 8 | 43 |
| 18 | 9.73959 | 19 | 9.81748 | 28 | 10.18252 | 9.92211 | 9 | 42 |
| 19 | 9.73978 | 20 | 9.81776 | 27 | 10.18224 | 9.92202 | 8 | 41 |
| 20 | 9.73997 | 19 | 9.81803 | 28 | 10.18197 | 9.92194 | 8 | 40 |
| 21 | 9.74017 | 19 | 9.81831 | 27 | 10.18169 | 9.92186 | 9 | 39 |
| 22 | 9.74036 | 20 | 9.81858 | 28 | 10.18142 | 9.92177 | 8 | 38 |
| 23 | 9.74055 | 19 | 9.81886 | 27 | 10.18114 | 9.92169 | 8 | 37 |
| 24 | 9.74074 | 19 | 9.81913 | 28 | 10.18087 | 9.92161 | 9 | 36 |
| 25 | 9.74093 | 20 | 9.81941 | 27 | 10.18059 | 9.92152 | 8 | 35 |
| 26 | 9.74113 | 19 | 9.81968 | 28 | 10.18032 | 9.92144 | 8 | 34 |
| 27 | 9.74132 | 19 | 9.81996 | 27 | 10.18004 | 9.92136 | 9 | 33 |
| 28 | 9.74151 | 20 | 9.82023 | 28 | 10.17977 | 9.92127 | 8 | 32 |
| 29 | 9.74170 | 19 | 9.82051 | 27 | 10.17949 | 9.92119 | 8 | 31 |
| 30 | 9.74189 | 19 | 9.82078 | 27 | 10.17922 | 9.92111 | 8 | 30 |
| ' | Cosine. | | Cotang. | | Tangent. | Sine. | | ' |

[56 degrees.]

[34 degrees.]

| | Sine. | Tangent. | Cotang. | Cosine. | D. | |
|----|---------|----------|----------|----------|----|----|
| 30 | 9.75313 | 18 | 9.87713 | 10.16287 | 8 | 30 |
| 31 | 9.75331 | 19 | 9.87731 | 10.16260 | 9 | 29 |
| 32 | 9.75350 | 18 | 9.87750 | 10.16232 | 9 | 28 |
| 33 | 9.75368 | 18 | 9.87768 | 10.16205 | 9 | 27 |
| 34 | 9.75386 | 18 | 9.87786 | 10.16178 | 8 | 26 |
| 35 | 9.75405 | 19 | 9.87805 | 10.16151 | 9 | 25 |
| 36 | 9.75423 | 18 | 9.87823 | 10.16124 | 9 | 24 |
| 37 | 9.75441 | 18 | 9.87841 | 10.16097 | 8 | 23 |
| 38 | 9.75459 | 19 | 9.87859 | 10.16070 | 9 | 22 |
| 39 | 9.75478 | 18 | 9.87878 | 10.16043 | 9 | 21 |
| 40 | 9.75496 | 18 | 9.87896 | 10.16016 | 9 | 20 |
| 41 | 9.75514 | 19 | 9.87914 | 10.15989 | 8 | 19 |
| 42 | 9.75533 | 18 | 9.87933 | 10.15962 | 9 | 18 |
| 43 | 9.75551 | 18 | 9.87951 | 10.15935 | 9 | 17 |
| 44 | 9.75569 | 18 | 9.87969 | 10.15908 | 9 | 16 |
| 45 | 9.75587 | 18 | 9.87987 | 10.15881 | 8 | 15 |
| 46 | 9.75605 | 19 | 9.88005 | 10.15854 | 9 | 14 |
| 47 | 9.75624 | 18 | 9.88024 | 10.15827 | 9 | 13 |
| 48 | 9.75642 | 18 | 9.88042 | 10.15800 | 9 | 12 |
| 49 | 9.75660 | 18 | 9.88060 | 10.15773 | 9 | 11 |
| 50 | 9.75678 | 18 | 9.88078 | 10.15746 | 8 | 10 |
| 51 | 9.75696 | 18 | 9.88096 | 10.15720 | 9 | 9 |
| 52 | 9.75714 | 18 | 9.88114 | 10.15693 | 9 | 8 |
| 53 | 9.75733 | 18 | 9.88133 | 10.15666 | 9 | 7 |
| 54 | 9.75751 | 18 | 9.88151 | 10.15639 | 9 | 6 |
| 55 | 9.75769 | 18 | 9.88169 | 10.15612 | 8 | 5 |
| 56 | 9.75787 | 18 | 9.88187 | 10.15585 | 9 | 4 |
| 57 | 9.75805 | 18 | 9.88205 | 10.15558 | 9 | 3 |
| 58 | 9.75823 | 18 | 9.88223 | 10.15531 | 9 | 2 |
| 59 | 9.75841 | 18 | 9.88241 | 10.15504 | 9 | 1 |
| 60 | 9.75859 | 18 | 9.88259 | 10.15477 | 9 | 0 |
| | Cosine. | Cotang. | Tangent. | Sine. | | |

[55 degrees.]

[34 degrees.]

| | Sine. | Tangent. | Cotang. | Cosine. | D. | |
|----|---------|----------|----------|---------|----|----|
| 0 | 9.74756 | 19 | 9.82899 | 9.91857 | 8 | 60 |
| 1 | 9.74774 | 19 | 9.82917 | 9.91840 | 9 | 59 |
| 2 | 9.74792 | 18 | 9.82935 | 9.91823 | 9 | 58 |
| 3 | 9.74810 | 18 | 9.82953 | 9.91806 | 8 | 57 |
| 4 | 9.74828 | 19 | 9.82971 | 9.91789 | 9 | 56 |
| 5 | 9.74846 | 18 | 9.82989 | 9.91772 | 8 | 55 |
| 6 | 9.74864 | 18 | 9.83007 | 9.91755 | 9 | 54 |
| 7 | 9.74882 | 19 | 9.83025 | 9.91738 | 8 | 53 |
| 8 | 9.74900 | 18 | 9.83043 | 9.91721 | 9 | 52 |
| 9 | 9.74918 | 18 | 9.83061 | 9.91704 | 8 | 51 |
| 10 | 9.74936 | 19 | 9.83079 | 9.91687 | 9 | 50 |
| 11 | 9.74954 | 18 | 9.83097 | 9.91670 | 8 | 49 |
| 12 | 9.74972 | 18 | 9.83115 | 9.91653 | 9 | 48 |
| 13 | 9.74990 | 19 | 9.83133 | 9.91636 | 8 | 47 |
| 14 | 9.75008 | 18 | 9.83151 | 9.91619 | 9 | 46 |
| 15 | 9.75026 | 18 | 9.83169 | 9.91602 | 8 | 45 |
| 16 | 9.75044 | 19 | 9.83187 | 9.91585 | 9 | 44 |
| 17 | 9.75062 | 18 | 9.83205 | 9.91568 | 8 | 43 |
| 18 | 9.75080 | 18 | 9.83223 | 9.91551 | 9 | 42 |
| 19 | 9.75098 | 19 | 9.83241 | 9.91534 | 8 | 41 |
| 20 | 9.75116 | 18 | 9.83259 | 9.91517 | 9 | 40 |
| 21 | 9.75134 | 18 | 9.83277 | 9.91500 | 8 | 39 |
| 22 | 9.75152 | 19 | 9.83295 | 9.91483 | 9 | 38 |
| 23 | 9.75170 | 18 | 9.83313 | 9.91466 | 8 | 37 |
| 24 | 9.75188 | 18 | 9.83331 | 9.91449 | 9 | 36 |
| 25 | 9.75206 | 19 | 9.83349 | 9.91432 | 8 | 35 |
| 26 | 9.75224 | 18 | 9.83367 | 9.91415 | 9 | 34 |
| 27 | 9.75242 | 18 | 9.83385 | 9.91398 | 8 | 33 |
| 28 | 9.75260 | 19 | 9.83403 | 9.91381 | 9 | 32 |
| 29 | 9.75278 | 18 | 9.83421 | 9.91364 | 8 | 31 |
| 30 | 9.75296 | 18 | 9.83439 | 9.91347 | 9 | 30 |
| | Cosine. | Cotang. | Tangent. | Sine. | | |

[55 degrees.]

[35 degrees.]

| ' | Sec. | DIF. | Tangent. | DIF. | Cotang. | Cosine. | D. | ' |
|----|---------|------|----------|------|-----------|---------|----|----|
| 0 | 9.73859 | 18 | 9.84523 | 27 | 10.154477 | 9.91336 | 8 | 60 |
| 1 | 9.73877 | 18 | 9.84550 | 26 | 10.15450 | 9.91328 | 8 | 59 |
| 2 | 9.73895 | 18 | 9.84576 | 26 | 10.15424 | 9.91319 | 9 | 58 |
| 3 | 9.73913 | 18 | 9.84603 | 27 | 10.15397 | 9.91310 | 9 | 57 |
| 4 | 9.73931 | 18 | 9.84630 | 27 | 10.15370 | 9.91301 | 9 | 56 |
| 5 | 9.73949 | 18 | 9.84657 | 27 | 10.15343 | 9.91292 | 9 | 55 |
| 6 | 9.73967 | 18 | 9.84684 | 27 | 10.15316 | 9.91283 | 9 | 54 |
| 7 | 9.73985 | 18 | 9.84711 | 27 | 10.15289 | 9.91274 | 8 | 53 |
| 8 | 9.76003 | 18 | 9.84738 | 26 | 10.15262 | 9.91266 | 8 | 52 |
| 9 | 9.76021 | 18 | 9.84764 | 27 | 10.15236 | 9.91257 | 9 | 51 |
| 10 | 9.76039 | 18 | 9.84791 | 27 | 10.15209 | 9.91248 | 9 | 50 |
| 11 | 9.76057 | 18 | 9.84818 | 27 | 10.15182 | 9.91239 | 9 | 49 |
| 12 | 9.76075 | 18 | 9.84845 | 27 | 10.15155 | 9.91230 | 9 | 48 |
| 13 | 9.76093 | 18 | 9.84872 | 27 | 10.15128 | 9.91221 | 9 | 47 |
| 14 | 9.76111 | 18 | 9.84899 | 26 | 10.15101 | 9.91212 | 9 | 46 |
| 15 | 9.76129 | 17 | 9.84925 | 27 | 10.15075 | 9.91203 | 9 | 45 |
| 16 | 9.76146 | 18 | 9.84952 | 27 | 10.15048 | 9.91194 | 9 | 44 |
| 17 | 9.76164 | 18 | 9.84979 | 27 | 10.15021 | 9.91185 | 9 | 43 |
| 18 | 9.76182 | 18 | 9.85006 | 27 | 10.14994 | 9.91176 | 9 | 42 |
| 19 | 9.76200 | 18 | 9.85033 | 26 | 10.14967 | 9.91167 | 9 | 41 |
| 20 | 9.76218 | 18 | 9.85059 | 27 | 10.14941 | 9.91158 | 9 | 40 |
| 21 | 9.76236 | 17 | 9.85086 | 27 | 10.14914 | 9.91149 | 8 | 39 |
| 22 | 9.76253 | 18 | 9.85113 | 27 | 10.14887 | 9.91141 | 8 | 38 |
| 23 | 9.76271 | 18 | 9.85140 | 26 | 10.14860 | 9.91132 | 9 | 37 |
| 24 | 9.76289 | 18 | 9.85166 | 27 | 10.14834 | 9.91123 | 9 | 36 |
| 25 | 9.76307 | 17 | 9.85193 | 27 | 10.14807 | 9.91114 | 9 | 35 |
| 26 | 9.76324 | 18 | 9.85220 | 27 | 10.14780 | 9.91105 | 9 | 34 |
| 27 | 9.76342 | 18 | 9.85247 | 26 | 10.14753 | 9.91096 | 9 | 33 |
| 28 | 9.76360 | 18 | 9.85273 | 27 | 10.14727 | 9.91087 | 9 | 32 |
| 29 | 9.76378 | 18 | 9.85300 | 27 | 10.14700 | 9.91078 | 9 | 31 |
| 30 | 9.76395 | 17 | 9.85327 | 27 | 10.14673 | 9.91069 | 9 | 30 |
| ' | Cotang. | | Cotang. | | Tangent. | Sine. | ' | |

[64 degrees.]

[35 degrees.]

| ' | Sine. | DIF. | Tangent. | DIF. | Cotang. | Cosine. | DIF. | ' |
|----|---------|------|----------|------|----------|---------|------|----|
| 30 | 9.76395 | 18 | 9.85327 | 27 | 10.14673 | 9.91069 | 9 | 30 |
| 31 | 9.76413 | 18 | 9.85354 | 26 | 10.14646 | 9.91060 | 9 | 29 |
| 32 | 9.76431 | 18 | 9.85380 | 27 | 10.14620 | 9.91051 | 9 | 28 |
| 33 | 9.76448 | 17 | 9.85407 | 27 | 10.14593 | 9.91042 | 9 | 27 |
| 34 | 9.76466 | 18 | 9.85434 | 26 | 10.14566 | 9.91033 | 10 | 26 |
| 35 | 9.76484 | 17 | 9.85460 | 27 | 10.14540 | 9.91023 | 9 | 25 |
| 36 | 9.76501 | 18 | 9.85487 | 27 | 10.14513 | 9.91014 | 9 | 24 |
| 37 | 9.76519 | 18 | 9.85514 | 26 | 10.14486 | 9.91005 | 9 | 23 |
| 38 | 9.76537 | 17 | 9.85540 | 27 | 10.14460 | 9.90996 | 9 | 22 |
| 39 | 9.76554 | 18 | 9.85567 | 27 | 10.14433 | 9.90987 | 9 | 21 |
| 40 | 9.76572 | 18 | 9.85594 | 26 | 10.14406 | 9.90978 | 9 | 20 |
| 41 | 9.76590 | 17 | 9.85620 | 27 | 10.14380 | 9.90969 | 9 | 19 |
| 42 | 9.76607 | 18 | 9.85647 | 27 | 10.14353 | 9.90960 | 9 | 18 |
| 43 | 9.76625 | 17 | 9.85674 | 26 | 10.14326 | 9.90951 | 9 | 17 |
| 44 | 9.76642 | 18 | 9.85700 | 27 | 10.14300 | 9.90942 | 9 | 16 |
| 45 | 9.76660 | 17 | 9.85727 | 27 | 10.14273 | 9.90933 | 9 | 15 |
| 46 | 9.76677 | 18 | 9.85754 | 26 | 10.14246 | 9.90924 | 9 | 14 |
| 47 | 9.76695 | 17 | 9.85780 | 27 | 10.14220 | 9.90915 | 9 | 13 |
| 48 | 9.76712 | 18 | 9.85807 | 27 | 10.14193 | 9.90906 | 10 | 12 |
| 49 | 9.76730 | 17 | 9.85834 | 26 | 10.14166 | 9.90896 | 9 | 11 |
| 50 | 9.76747 | 18 | 9.85860 | 27 | 10.14140 | 9.90887 | 9 | 10 |
| 51 | 9.76765 | 17 | 9.85887 | 26 | 10.14113 | 9.90878 | 9 | 9 |
| 52 | 9.76782 | 18 | 9.85913 | 27 | 10.14087 | 9.90869 | 9 | 8 |
| 53 | 9.76800 | 17 | 9.85940 | 27 | 10.14060 | 9.90860 | 9 | 7 |
| 54 | 9.76817 | 18 | 9.85967 | 26 | 10.14033 | 9.90851 | 9 | 6 |
| 55 | 9.76835 | 17 | 9.85993 | 27 | 10.14007 | 9.90842 | 10 | 5 |
| 56 | 9.76852 | 18 | 9.86020 | 26 | 10.13980 | 9.90832 | 9 | 4 |
| 57 | 9.76870 | 17 | 9.86046 | 27 | 10.13954 | 9.90823 | 9 | 3 |
| 58 | 9.76887 | 17 | 9.86073 | 27 | 10.13927 | 9.90814 | 9 | 2 |
| 59 | 9.76904 | 18 | 9.86100 | 26 | 10.13900 | 9.90805 | 9 | 1 |
| 60 | 9.76922 | | 9.86126 | | 10.13874 | 9.90796 | 9 | 0 |
| ' | Cosine. | | Cotang. | | Sine. | | ' | |

[64 degrees.]

[36 degrees.]

| ' | Sine. | Diff. | Tangent. | Diff. | Cotang. | Diff. | Cosine. | Diff. | ' |
|----|---------|-------|----------|-------|----------|---------|---------|-------|---|
| 30 | 9'77439 | 17 | 9'86021 | 26 | 10'13079 | 9'90218 | 30 | | |
| 29 | 9'77456 | 17 | 9'86047 | 27 | 10'13053 | 9'90509 | 29 | | |
| 31 | 9'77473 | 17 | 9'86074 | 26 | 10'13026 | 9'90499 | 28 | | |
| 32 | 9'77490 | 17 | 9'86100 | 26 | 10'13000 | 9'90490 | 27 | | |
| 33 | 9'77507 | 17 | 9'86127 | 26 | 10'12973 | 9'90480 | 26 | | |
| 34 | 9'77524 | 17 | 9'86153 | 26 | 10'12947 | 9'90471 | 25 | | |
| 35 | 9'77541 | 17 | 9'86179 | 26 | 10'12921 | 9'90462 | 24 | | |
| 36 | 9'77558 | 17 | 9'86205 | 26 | 10'12894 | 9'90452 | 23 | | |
| 37 | 9'77575 | 17 | 9'86231 | 26 | 10'12868 | 9'90443 | 22 | | |
| 38 | 9'77592 | 17 | 9'86257 | 26 | 10'12842 | 9'90434 | 21 | | |
| 39 | 9'77609 | 17 | 9'86283 | 26 | 10'12815 | 9'90424 | 20 | | |
| 40 | 9'77626 | 17 | 9'86309 | 26 | 10'12789 | 9'90415 | 19 | | |
| 41 | 9'77643 | 17 | 9'86335 | 26 | 10'12762 | 9'90405 | 18 | | |
| 42 | 9'77660 | 17 | 9'86361 | 26 | 10'12736 | 9'90396 | 17 | | |
| 43 | 9'77677 | 17 | 9'86387 | 26 | 10'12710 | 9'90386 | 16 | | |
| 44 | 9'77694 | 17 | 9'86413 | 26 | 10'12683 | 9'90377 | 15 | | |
| 45 | 9'77711 | 17 | 9'86439 | 26 | 10'12657 | 9'90368 | 14 | | |
| 46 | 9'77728 | 16 | 9'86465 | 27 | 10'12631 | 9'90358 | 13 | | |
| 47 | 9'77744 | 17 | 9'86491 | 26 | 10'12604 | 9'90349 | 12 | | |
| 48 | 9'77761 | 17 | 9'86517 | 26 | 10'12578 | 9'90339 | 11 | | |
| 49 | 9'77778 | 17 | 9'86543 | 26 | 10'12552 | 9'90330 | 10 | | |
| 50 | 9'77795 | 17 | 9'86569 | 26 | 10'12525 | 9'90320 | 9 | | |
| 51 | 9'77812 | 17 | 9'86595 | 26 | 10'12499 | 9'90311 | 8 | | |
| 52 | 9'77829 | 17 | 9'86621 | 26 | 10'12473 | 9'90301 | 7 | | |
| 53 | 9'77846 | 16 | 9'86647 | 27 | 10'12446 | 9'90292 | 6 | | |
| 54 | 9'77862 | 17 | 9'86673 | 26 | 10'12420 | 9'90282 | 5 | | |
| 55 | 9'77879 | 17 | 9'86699 | 26 | 10'12394 | 9'90273 | 4 | | |
| 56 | 9'77896 | 17 | 9'86725 | 26 | 10'12367 | 9'90263 | 3 | | |
| 57 | 9'77913 | 17 | 9'86751 | 26 | 10'12341 | 9'90254 | 2 | | |
| 58 | 9'77930 | 16 | 9'86777 | 26 | 10'12315 | 9'90244 | 1 | | |
| 59 | 9'77946 | 16 | 9'86803 | 26 | 10'12289 | 9'90235 | 0 | | |
| 60 | 9'77963 | | | | | | | | |

[53 degrees.]

[36 degrees.]

| ' | Sine. | Diff. | Tangent. | Diff. | Cotang. | Diff. | Cosine. | Diff. | ' |
|----|---------|-------|----------|-------|----------|---------|---------|-------|---|
| 0 | 9'76922 | 17 | 9'86126 | 27 | 10'13874 | 9'90796 | 60 | | |
| 1 | 9'76939 | 18 | 9'86153 | 26 | 10'13847 | 9'90787 | 59 | | |
| 2 | 9'76957 | 17 | 9'86179 | 27 | 10'13821 | 9'90777 | 58 | | |
| 3 | 9'76974 | 17 | 9'86206 | 26 | 10'13794 | 9'90768 | 57 | | |
| 4 | 9'76991 | 18 | 9'86232 | 26 | 10'13768 | 9'90759 | 56 | | |
| 5 | 9'77009 | 17 | 9'86259 | 26 | 10'13741 | 9'90750 | 55 | | |
| 6 | 9'77026 | 17 | 9'86285 | 27 | 10'13715 | 9'90741 | 54 | | |
| 7 | 9'77043 | 18 | 9'86312 | 26 | 10'13688 | 9'90731 | 53 | | |
| 8 | 9'77061 | 17 | 9'86338 | 27 | 10'13662 | 9'90722 | 52 | | |
| 9 | 9'77078 | 17 | 9'86365 | 26 | 10'13635 | 9'90713 | 51 | | |
| 10 | 9'77095 | 17 | 9'86392 | 26 | 10'13608 | 9'90704 | 50 | | |
| 11 | 9'77112 | 18 | 9'86418 | 27 | 10'13582 | 9'90694 | 49 | | |
| 12 | 9'77130 | 17 | 9'86445 | 26 | 10'13555 | 9'90685 | 48 | | |
| 13 | 9'77147 | 17 | 9'86471 | 27 | 10'13529 | 9'90676 | 47 | | |
| 14 | 9'77164 | 17 | 9'86498 | 26 | 10'13502 | 9'90667 | 46 | | |
| 15 | 9'77181 | 18 | 9'86524 | 27 | 10'13476 | 9'90657 | 45 | | |
| 16 | 9'77199 | 17 | 9'86551 | 26 | 10'13449 | 9'90648 | 44 | | |
| 17 | 9'77216 | 17 | 9'86577 | 26 | 10'13423 | 9'90639 | 43 | | |
| 18 | 9'77233 | 17 | 9'86603 | 27 | 10'13397 | 9'90630 | 42 | | |
| 19 | 9'77250 | 18 | 9'86630 | 26 | 10'13370 | 9'90620 | 41 | | |
| 20 | 9'77268 | 17 | 9'86656 | 27 | 10'13344 | 9'90611 | 40 | | |
| 21 | 9'77285 | 17 | 9'86683 | 26 | 10'13317 | 9'90602 | 39 | | |
| 22 | 9'77302 | 17 | 9'86709 | 27 | 10'13291 | 9'90592 | 38 | | |
| 23 | 9'77319 | 17 | 9'86736 | 26 | 10'13264 | 9'90583 | 37 | | |
| 24 | 9'77336 | 17 | 9'86762 | 27 | 10'13238 | 9'90574 | 36 | | |
| 25 | 9'77353 | 18 | 9'86789 | 26 | 10'13211 | 9'90565 | 35 | | |
| 26 | 9'77370 | 17 | 9'86815 | 27 | 10'13185 | 9'90555 | 34 | | |
| 27 | 9'77387 | 17 | 9'86842 | 26 | 10'13158 | 9'90546 | 33 | | |
| 28 | 9'77405 | 18 | 9'86868 | 26 | 10'13132 | 9'90537 | 32 | | |
| 29 | 9'77422 | 17 | 9'86894 | 27 | 10'13106 | 9'90527 | 31 | | |
| 30 | 9'77439 | | 9'86921 | | 10'13079 | 9'90518 | 30 | | |
| ' | Cosine. | | Cotang. | | Tangent. | | Sine. | | ' |

[53 degrees.]

[37 degrees.]

| ' | Sine. | Diff. | Tangent. | Diff. | Cotang. | Diff. | Cosine. | Diff. | ' |
|----|---------|-------|----------|-------|----------|---------|---------|-------|---|
| 30 | 9'78445 | 16 | 9'88498 | 26 | 10'11502 | 9'89947 | 10 | 30 | |
| 31 | 9'78461 | 17 | 9'88524 | 26 | 10'11476 | 9'89917 | 10 | 29 | |
| 32 | 9'78478 | 17 | 9'88550 | 27 | 10'11450 | 9'89927 | 9 | 28 | |
| 33 | 9'78494 | 16 | 9'88577 | 26 | 10'11423 | 9'89918 | 10 | 27 | |
| 34 | 9'78510 | 17 | 9'88603 | 26 | 10'11397 | 9'89908 | 10 | 26 | |
| 35 | 9'78527 | 16 | 9'88629 | 26 | 10'11371 | 9'89898 | 10 | 25 | |
| 36 | 9'78543 | 17 | 9'88655 | 26 | 10'11345 | 9'89888 | 10 | 24 | |
| 37 | 9'78560 | 16 | 9'88681 | 26 | 10'11319 | 9'89879 | 9 | 23 | |
| 38 | 9'78576 | 16 | 9'88707 | 26 | 10'11293 | 9'89869 | 10 | 22 | |
| 39 | 9'78592 | 17 | 9'88733 | 26 | 10'11267 | 9'89859 | 10 | 21 | |
| 40 | 9'78609 | 16 | 9'88759 | 27 | 10'11241 | 9'89849 | 9 | 20 | |
| 41 | 9'78625 | 17 | 9'88786 | 26 | 10'11214 | 9'89840 | 10 | 19 | |
| 42 | 9'78642 | 16 | 9'88812 | 26 | 10'11188 | 9'89830 | 10 | 18 | |
| 43 | 9'78658 | 16 | 9'88838 | 26 | 10'11162 | 9'89820 | 10 | 17 | |
| 44 | 9'78674 | 17 | 9'88864 | 26 | 10'11136 | 9'89810 | 9 | 16 | |
| 45 | 9'78691 | 16 | 9'88890 | 26 | 10'11110 | 9'89801 | 10 | 15 | |
| 46 | 9'78707 | 16 | 9'88916 | 26 | 10'11084 | 9'89791 | 10 | 14 | |
| 47 | 9'78723 | 16 | 9'88942 | 26 | 10'11058 | 9'89781 | 10 | 13 | |
| 48 | 9'78739 | 17 | 9'88968 | 26 | 10'11032 | 9'89771 | 10 | 12 | |
| 49 | 9'78756 | 16 | 9'88994 | 26 | 10'11006 | 9'89761 | 9 | 11 | |
| 50 | 9'78772 | 16 | 9'89020 | 26 | 10'10980 | 9'89752 | 10 | 10 | |
| 51 | 9'78788 | 17 | 9'89046 | 27 | 10'10954 | 9'89742 | 10 | 9 | |
| 52 | 9'78805 | 16 | 9'89073 | 26 | 10'10927 | 9'89732 | 10 | 8 | |
| 53 | 9'78821 | 16 | 9'89099 | 26 | 10'10901 | 9'89722 | 10 | 7 | |
| 54 | 9'78837 | 16 | 9'89125 | 26 | 10'10875 | 9'89712 | 10 | 6 | |
| 55 | 9'78853 | 16 | 9'89151 | 26 | 10'10849 | 9'89702 | 9 | 5 | |
| 56 | 9'78869 | 17 | 9'89177 | 26 | 10'10823 | 9'89693 | 10 | 4 | |
| 57 | 9'78886 | 16 | 9'89203 | 26 | 10'10797 | 9'89683 | 10 | 3 | |
| 58 | 9'78902 | 16 | 9'89229 | 26 | 10'10771 | 9'89673 | 10 | 2 | |
| 59 | 9'78918 | 16 | 9'89255 | 26 | 10'10745 | 9'89663 | 10 | 1 | |
| 60 | 9'78934 | | 9'89281 | | 10'10719 | 9'89653 | | 0 | |
| ' | Cosine. | | Cotang. | | Tangent. | Sine. | | | ' |

[52 degrees.]

[37 degrees.]

| ' | Sine. | Diff. | Tangent. | Diff. | Cotang. | Diff. | Cosine. | Diff. | ' |
|----|---------|-------|----------|-------|----------|---------|---------|-------|---|
| 0 | 9'77946 | 17 | 9'87711 | 27 | 10'12289 | 9'90235 | 10 | 60 | |
| 1 | 9'77963 | 17 | 9'87738 | 26 | 10'12262 | 9'90225 | 9 | 59 | |
| 2 | 9'77980 | 17 | 9'87764 | 26 | 10'12236 | 9'90216 | 9 | 58 | |
| 3 | 9'77997 | 16 | 9'87790 | 27 | 10'12210 | 9'90206 | 10 | 57 | |
| 4 | 9'78013 | 17 | 9'87817 | 26 | 10'12183 | 9'90197 | 9 | 56 | |
| 5 | 9'78030 | 17 | 9'87843 | 26 | 10'12157 | 9'90187 | 10 | 55 | |
| 6 | 9'78047 | 16 | 9'87869 | 26 | 10'12131 | 9'90178 | 9 | 54 | |
| 7 | 9'78063 | 17 | 9'87895 | 27 | 10'12105 | 9'90168 | 10 | 53 | |
| 8 | 9'78080 | 17 | 9'87922 | 26 | 10'12078 | 9'90159 | 9 | 52 | |
| 9 | 9'78097 | 16 | 9'87948 | 26 | 10'12052 | 9'90149 | 10 | 51 | |
| 10 | 9'78113 | 17 | 9'87974 | 26 | 10'12026 | 9'90139 | 9 | 50 | |
| 11 | 9'78130 | 17 | 9'88000 | 27 | 10'12000 | 9'90130 | 10 | 49 | |
| 12 | 9'78147 | 16 | 9'88027 | 26 | 10'11973 | 9'90120 | 9 | 48 | |
| 13 | 9'78163 | 17 | 9'88053 | 26 | 10'11947 | 9'90111 | 10 | 47 | |
| 14 | 9'78180 | 17 | 9'88079 | 26 | 10'11921 | 9'90101 | 9 | 46 | |
| 15 | 9'78197 | 16 | 9'88105 | 26 | 10'11895 | 9'90091 | 10 | 45 | |
| 16 | 9'78213 | 17 | 9'88131 | 27 | 10'11869 | 9'90082 | 9 | 44 | |
| 17 | 9'78230 | 16 | 9'88158 | 26 | 10'11842 | 9'90072 | 10 | 43 | |
| 18 | 9'78246 | 17 | 9'88184 | 26 | 10'11816 | 9'90063 | 9 | 42 | |
| 19 | 9'78263 | 17 | 9'88210 | 26 | 10'11790 | 9'90053 | 10 | 41 | |
| 20 | 9'78280 | 16 | 9'88236 | 26 | 10'11764 | 9'90043 | 9 | 40 | |
| 21 | 9'78296 | 17 | 9'88262 | 27 | 10'11738 | 9'90034 | 10 | 39 | |
| 22 | 9'78313 | 16 | 9'88289 | 26 | 10'11711 | 9'90024 | 9 | 38 | |
| 23 | 9'78329 | 17 | 9'88315 | 26 | 10'11685 | 9'90014 | 10 | 37 | |
| 24 | 9'78346 | 16 | 9'88341 | 26 | 10'11659 | 9'90005 | 9 | 36 | |
| 25 | 9'78362 | 17 | 9'88367 | 26 | 10'11633 | 9'89995 | 10 | 35 | |
| 26 | 9'78379 | 16 | 9'88393 | 26 | 10'11607 | 9'89985 | 9 | 34 | |
| 27 | 9'78395 | 17 | 9'88420 | 26 | 10'11580 | 9'89976 | 10 | 33 | |
| 28 | 9'78412 | 16 | 9'88446 | 26 | 10'11554 | 9'89966 | 9 | 32 | |
| 29 | 9'78428 | 17 | 9'88472 | 26 | 10'11528 | 9'89956 | 10 | 31 | |
| 30 | 9'78445 | | 9'88498 | 26 | 10'11502 | 9'89947 | 9 | 30 | |
| ' | Cosine. | | Cotang. | | Tangent. | Sine. | | ' | |

[52 degrees.]

[38 degrees.]

| ' | Sine. | Diff. | Tangent. | Diff. | Cotang. | Cosine. | Diff. | ' |
|----|---------|-------|----------|-------|----------|---------|-------|----|
| 30 | 9.79415 | 16 | 9.90061 | 25 | 10.09939 | 9.89354 | 10 | 30 |
| 31 | 9.79431 | 16 | 9.90086 | 26 | 10.09914 | 9.89344 | 10 | 29 |
| 32 | 9.79447 | 16 | 9.90112 | 26 | 10.09888 | 9.89334 | 10 | 28 |
| 33 | 9.79463 | 15 | 9.90138 | 26 | 10.09862 | 9.89324 | 10 | 27 |
| 34 | 9.79478 | 16 | 9.90164 | 26 | 10.09836 | 9.89314 | 10 | 26 |
| 35 | 9.79494 | 16 | 9.90190 | 26 | 10.09810 | 9.89304 | 10 | 25 |
| 36 | 9.79510 | 16 | 9.90216 | 26 | 10.09784 | 9.89294 | 10 | 24 |
| 37 | 9.79526 | 16 | 9.90242 | 26 | 10.09758 | 9.89284 | 10 | 23 |
| 38 | 9.79542 | 16 | 9.90268 | 26 | 10.09732 | 9.89274 | 10 | 22 |
| 39 | 9.79558 | 15 | 9.90294 | 26 | 10.09706 | 9.89264 | 10 | 21 |
| 40 | 9.79573 | 16 | 9.90320 | 26 | 10.09680 | 9.89254 | 10 | 20 |
| 41 | 9.79589 | 16 | 9.90346 | 25 | 10.09654 | 9.89244 | 11 | 19 |
| 42 | 9.79605 | 16 | 9.90371 | 26 | 10.09629 | 9.89234 | 11 | 18 |
| 43 | 9.79621 | 15 | 9.90397 | 26 | 10.09603 | 9.89223 | 10 | 17 |
| 44 | 9.79636 | 16 | 9.90423 | 26 | 10.09577 | 9.89213 | 10 | 16 |
| 45 | 9.79652 | 16 | 9.90449 | 26 | 10.09551 | 9.89203 | 10 | 15 |
| 46 | 9.79668 | 16 | 9.90475 | 26 | 10.09525 | 9.89193 | 10 | 14 |
| 47 | 9.79684 | 15 | 9.90501 | 26 | 10.09499 | 9.89183 | 10 | 13 |
| 48 | 9.79699 | 16 | 9.90527 | 26 | 10.09473 | 9.89173 | 11 | 12 |
| 49 | 9.79715 | 16 | 9.90553 | 25 | 10.09447 | 9.89162 | 10 | 11 |
| 50 | 9.79731 | 15 | 9.90578 | 26 | 10.09422 | 9.89152 | 10 | 10 |
| 51 | 9.79746 | 16 | 9.90604 | 26 | 10.09396 | 9.89142 | 10 | 9 |
| 52 | 9.79762 | 16 | 9.90630 | 26 | 10.09370 | 9.89132 | 10 | 8 |
| 53 | 9.79778 | 15 | 9.90656 | 26 | 10.09344 | 9.89122 | 10 | 7 |
| 54 | 9.79793 | 16 | 9.90682 | 26 | 10.09318 | 9.89112 | 11 | 6 |
| 55 | 9.79809 | 16 | 9.90708 | 26 | 10.09292 | 9.89101 | 10 | 5 |
| 56 | 9.79825 | 15 | 9.90734 | 25 | 10.09266 | 9.89091 | 10 | 4 |
| 57 | 9.79840 | 16 | 9.90759 | 26 | 10.09241 | 9.89081 | 10 | 3 |
| 58 | 9.79856 | 16 | 9.90785 | 26 | 10.09215 | 9.89071 | 11 | 2 |
| 59 | 9.79872 | 15 | 9.90811 | 26 | 10.09189 | 9.89060 | 10 | 1 |
| 60 | 9.79887 | | 9.90837 | | 10.09163 | 9.89050 | | 0 |
| ' | Cosine. | | Cotang. | | Tangent. | Sine. | | ' |

[51 degrees.]

[38 degrees.]

| ' | Sine. | Diff. | Tangent. | Diff. | Cotang. | Cosine. | Diff. | ' |
|----|---------|-------|----------|-------|----------|---------|-------|----|
| 0 | 9.78934 | 16 | 9.89281 | 26 | 10.10719 | 9.89653 | 10 | 60 |
| 1 | 9.78950 | 17 | 9.89307 | 26 | 10.10693 | 9.89643 | 10 | 59 |
| 2 | 9.78967 | 16 | 9.89333 | 26 | 10.10667 | 9.89633 | 9 | 58 |
| 3 | 9.78983 | 16 | 9.89359 | 26 | 10.10641 | 9.89624 | 10 | 57 |
| 4 | 9.78999 | 16 | 9.89385 | 26 | 10.10615 | 9.89614 | 10 | 56 |
| 5 | 9.79015 | 16 | 9.89411 | 26 | 10.10589 | 9.89604 | 10 | 55 |
| 6 | 9.79031 | 16 | 9.89437 | 26 | 10.10563 | 9.89594 | 10 | 54 |
| 7 | 9.79047 | 16 | 9.89463 | 26 | 10.10537 | 9.89584 | 10 | 53 |
| 8 | 9.79063 | 16 | 9.89489 | 26 | 10.10511 | 9.89574 | 10 | 52 |
| 9 | 9.79079 | 16 | 9.89515 | 26 | 10.10485 | 9.89564 | 10 | 51 |
| 10 | 9.79095 | 16 | 9.89541 | 26 | 10.10459 | 9.89554 | 10 | 50 |
| 11 | 9.79111 | 17 | 9.89567 | 26 | 10.10433 | 9.89544 | 10 | 49 |
| 12 | 9.79128 | 16 | 9.89593 | 26 | 10.10407 | 9.89534 | 10 | 48 |
| 13 | 9.79144 | 16 | 9.89619 | 26 | 10.10381 | 9.89524 | 10 | 47 |
| 14 | 9.79160 | 16 | 9.89645 | 26 | 10.10355 | 9.89514 | 10 | 46 |
| 15 | 9.79176 | 16 | 9.89671 | 26 | 10.10329 | 9.89504 | 9 | 45 |
| 16 | 9.79192 | 16 | 9.89697 | 26 | 10.10303 | 9.89495 | 10 | 44 |
| 17 | 9.79208 | 16 | 9.89723 | 26 | 10.10277 | 9.89485 | 10 | 43 |
| 18 | 9.79224 | 16 | 9.89749 | 26 | 10.10251 | 9.89475 | 10 | 42 |
| 19 | 9.79240 | 16 | 9.89775 | 26 | 10.10225 | 9.89465 | 10 | 41 |
| 20 | 9.79256 | 16 | 9.89801 | 26 | 10.10199 | 9.89455 | 10 | 40 |
| 21 | 9.79272 | 16 | 9.89827 | 26 | 10.10173 | 9.89445 | 10 | 39 |
| 22 | 9.79288 | 16 | 9.89853 | 26 | 10.10147 | 9.89435 | 10 | 38 |
| 23 | 9.79304 | 15 | 9.89879 | 26 | 10.10121 | 9.89425 | 10 | 37 |
| 24 | 9.79319 | 16 | 9.89905 | 26 | 10.10095 | 9.89415 | 10 | 36 |
| 25 | 9.79335 | 16 | 9.89931 | 26 | 10.10069 | 9.89405 | 10 | 35 |
| 26 | 9.79351 | 16 | 9.89957 | 26 | 10.10043 | 9.89395 | 10 | 34 |
| 27 | 9.79367 | 16 | 9.89983 | 26 | 10.10017 | 9.89385 | 10 | 33 |
| 28 | 9.79383 | 16 | 9.90009 | 26 | 10.09991 | 9.89375 | 11 | 32 |
| 29 | 9.79399 | 16 | 9.90035 | 26 | 10.09965 | 9.89364 | 10 | 31 |
| 30 | 9.79415 | | 9.90061 | | 10.09939 | 9.89354 | | 30 |
| ' | Cosine. | | Cotang. | | Tangent. | Sine. | | ' |

[51 degrees.]

[39 degrees.]

| ' | Sine. | Diff. | Tangent. | Cotang. | Cosine. | Diff. | ' |
|----|---------|-------|----------|----------|---------|-------|----|
| 0 | 9.79887 | 16 | 9.90837 | 10.09163 | 9.89050 | 10 | 59 |
| 1 | 9.79903 | 15 | 9.90863 | 10.09137 | 9.89040 | 10 | 58 |
| 2 | 9.79918 | 15 | 9.90889 | 10.09111 | 9.89030 | 10 | 57 |
| 3 | 9.79934 | 16 | 9.90914 | 10.09086 | 9.89020 | 11 | 56 |
| 4 | 9.79950 | 15 | 9.90940 | 10.09060 | 9.89009 | 10 | 55 |
| 5 | 9.79965 | 16 | 9.90966 | 10.09034 | 9.88999 | 10 | 54 |
| 6 | 9.79981 | 15 | 9.90992 | 10.09008 | 9.88989 | 11 | 53 |
| 7 | 9.79996 | 15 | 9.91018 | 10.08982 | 9.88978 | 10 | 52 |
| 8 | 9.80012 | 15 | 9.91043 | 10.08957 | 9.88968 | 10 | 51 |
| 9 | 9.80027 | 16 | 9.91069 | 10.08931 | 9.88958 | 10 | 50 |
| 10 | 9.80043 | 15 | 9.91095 | 10.08905 | 9.88948 | 11 | 49 |
| 11 | 9.80058 | 15 | 9.91121 | 10.08879 | 9.88937 | 10 | 48 |
| 12 | 9.80074 | 15 | 9.91147 | 10.08853 | 9.88927 | 10 | 47 |
| 13 | 9.80089 | 15 | 9.91172 | 10.08828 | 9.88917 | 11 | 46 |
| 14 | 9.80105 | 15 | 9.91198 | 10.08802 | 9.88906 | 10 | 45 |
| 15 | 9.80120 | 16 | 9.91224 | 10.08776 | 9.88896 | 10 | 44 |
| 16 | 9.80136 | 15 | 9.91250 | 10.08750 | 9.88886 | 11 | 43 |
| 17 | 9.80151 | 15 | 9.91276 | 10.08724 | 9.88875 | 10 | 42 |
| 18 | 9.80166 | 16 | 9.91301 | 10.08699 | 9.88865 | 10 | 41 |
| 19 | 9.80182 | 15 | 9.91327 | 10.08673 | 9.88855 | 11 | 40 |
| 20 | 9.80197 | 16 | 9.91353 | 10.08647 | 9.88844 | 10 | 39 |
| 21 | 9.80213 | 15 | 9.91379 | 10.08621 | 9.88834 | 10 | 38 |
| 22 | 9.80228 | 16 | 9.91404 | 10.08596 | 9.88824 | 11 | 37 |
| 23 | 9.80244 | 15 | 9.91430 | 10.08570 | 9.88813 | 10 | 36 |
| 24 | 9.80259 | 15 | 9.91456 | 10.08544 | 9.88803 | 10 | 35 |
| 25 | 9.80274 | 16 | 9.91482 | 10.08518 | 9.88793 | 11 | 34 |
| 26 | 9.80290 | 15 | 9.91507 | 10.08493 | 9.88782 | 10 | 33 |
| 27 | 9.80305 | 15 | 9.91533 | 10.08467 | 9.88772 | 11 | 32 |
| 28 | 9.80320 | 16 | 9.91559 | 10.08441 | 9.88761 | 10 | 31 |
| 29 | 9.80336 | 15 | 9.91585 | 10.08415 | 9.88751 | 10 | 30 |
| 30 | 9.80351 | 15 | 9.91610 | 10.08390 | 9.88741 | 10 | 29 |
| ' | Cosine. | | Cotang. | Tangent. | Sine. | | ' |

[50 degrees.]

[39 degrees.]

| ' | Sine. | Diff. | Tangent. | Cotang. | Cosine. | Diff. | ' |
|----|---------|-------|----------|----------|---------|-------|----|
| 30 | 9.80351 | 15 | 9.91610 | 10.08390 | 9.88741 | 11 | 30 |
| 31 | 9.80366 | 16 | 9.91636 | 10.08364 | 9.88730 | 11 | 29 |
| 32 | 9.80382 | 15 | 9.91662 | 10.08338 | 9.88720 | 11 | 28 |
| 33 | 9.80397 | 15 | 9.91688 | 10.08312 | 9.88709 | 10 | 27 |
| 34 | 9.80412 | 16 | 9.91713 | 10.08287 | 9.88699 | 11 | 26 |
| 35 | 9.80428 | 15 | 9.91739 | 10.08261 | 9.88688 | 10 | 25 |
| 36 | 9.80443 | 15 | 9.91765 | 10.08235 | 9.88678 | 10 | 24 |
| 37 | 9.80458 | 15 | 9.91791 | 10.08209 | 9.88668 | 11 | 23 |
| 38 | 9.80473 | 16 | 9.91816 | 10.08184 | 9.88657 | 10 | 22 |
| 39 | 9.80489 | 15 | 9.91842 | 10.08158 | 9.88647 | 11 | 21 |
| 40 | 9.80504 | 15 | 9.91868 | 10.08132 | 9.88636 | 10 | 20 |
| 41 | 9.80519 | 15 | 9.91893 | 10.08107 | 9.88626 | 10 | 19 |
| 42 | 9.80534 | 16 | 9.91919 | 10.08081 | 9.88615 | 11 | 18 |
| 43 | 9.80550 | 15 | 9.91945 | 10.08055 | 9.88605 | 10 | 17 |
| 44 | 9.80565 | 15 | 9.91971 | 10.08029 | 9.88594 | 11 | 16 |
| 45 | 9.80580 | 15 | 9.91996 | 10.08004 | 9.88584 | 10 | 15 |
| 46 | 9.80595 | 15 | 9.92022 | 10.07978 | 9.88573 | 11 | 14 |
| 47 | 9.80610 | 15 | 9.92048 | 10.07953 | 9.88563 | 10 | 13 |
| 48 | 9.80625 | 16 | 9.92073 | 10.07927 | 9.88552 | 11 | 12 |
| 49 | 9.80641 | 15 | 9.92099 | 10.07901 | 9.88542 | 10 | 11 |
| 50 | 9.80656 | 15 | 9.92125 | 10.07875 | 9.88531 | 10 | 10 |
| 51 | 9.80671 | 15 | 9.92150 | 10.07850 | 9.88521 | 9 | 9 |
| 52 | 9.80686 | 15 | 9.92176 | 10.07824 | 9.88510 | 11 | 8 |
| 53 | 9.80701 | 15 | 9.92202 | 10.07798 | 9.88499 | 10 | 7 |
| 54 | 9.80716 | 15 | 9.92227 | 10.07773 | 9.88489 | 11 | 6 |
| 55 | 9.80731 | 15 | 9.92253 | 10.07747 | 9.88478 | 10 | 5 |
| 56 | 9.80746 | 16 | 9.92279 | 10.07721 | 9.88468 | 11 | 4 |
| 57 | 9.80762 | 15 | 9.92304 | 10.07696 | 9.88457 | 10 | 3 |
| 58 | 9.80777 | 15 | 9.92330 | 10.07670 | 9.88447 | 11 | 2 |
| 59 | 9.80792 | 15 | 9.92356 | 10.07644 | 9.88436 | 11 | 1 |
| 60 | 9.80807 | 15 | 9.92381 | 10.07619 | 9.88425 | 11 | 0 |
| ' | Cosine. | | Cotang. | Tangent. | Sine. | | ' |

[50 degrees.]

[40 degrees.]

| | Sine. | Diff. | Tangent. | Diff. | Cotang. | Cosine. | Diff. | |
|----|---------|---------|----------|-------|----------|---------|-------|----|
| 0 | 9'80807 | 15 | 9'92381 | 26 | 10'07619 | 9'88425 | 10 | 60 |
| 1 | 9'80827 | 15 | 9'92407 | 26 | 10'07593 | 9'88415 | 11 | 59 |
| 2 | 9'80837 | 15 | 9'92433 | 26 | 10'07567 | 9'88404 | 11 | 58 |
| 3 | 9'80852 | 15 | 9'92458 | 25 | 10'07542 | 9'88394 | 10 | 57 |
| 4 | 9'80867 | 15 | 9'92484 | 26 | 10'07516 | 9'88383 | 11 | 56 |
| 5 | 9'80882 | 15 | 9'92510 | 25 | 10'07490 | 9'88372 | 11 | 55 |
| 6 | 9'80897 | 15 | 9'92535 | 26 | 10'07465 | 9'88362 | 10 | 54 |
| 7 | 9'80912 | 15 | 9'92561 | 26 | 10'07439 | 9'88351 | 11 | 53 |
| 8 | 9'80927 | 15 | 9'92587 | 25 | 10'07413 | 9'88340 | 11 | 52 |
| 9 | 9'80942 | 15 | 9'92612 | 26 | 10'07388 | 9'88330 | 10 | 51 |
| 10 | 9'80957 | 15 | 9'92638 | 26 | 10'07362 | 9'88319 | 11 | 50 |
| 11 | 9'80972 | 15 | 9'92663 | 25 | 10'07337 | 9'88308 | 11 | 49 |
| 12 | 9'80987 | 15 | 9'92689 | 26 | 10'07311 | 9'88298 | 10 | 48 |
| 13 | 9'81002 | 15 | 9'92715 | 25 | 10'07285 | 9'88287 | 11 | 47 |
| 14 | 9'81017 | 15 | 9'92740 | 26 | 10'07260 | 9'88276 | 11 | 46 |
| 15 | 9'81032 | 15 | 9'92766 | 26 | 10'07234 | 9'88266 | 10 | 45 |
| 16 | 9'81047 | 14 | 9'92792 | 25 | 10'07208 | 9'88255 | 11 | 44 |
| 17 | 9'81061 | 15 | 9'92817 | 26 | 10'07183 | 9'88244 | 11 | 43 |
| 18 | 9'81076 | 15 | 9'92843 | 25 | 10'07157 | 9'88234 | 10 | 42 |
| 19 | 9'81091 | 15 | 9'92868 | 26 | 10'07132 | 9'88223 | 11 | 41 |
| 20 | 9'81106 | 15 | 9'92894 | 26 | 10'07106 | 9'88212 | 11 | 40 |
| 21 | 9'81121 | 15 | 9'92920 | 25 | 10'07080 | 9'88201 | 11 | 39 |
| 22 | 9'81136 | 15 | 9'92945 | 26 | 10'07055 | 9'88191 | 10 | 38 |
| 23 | 9'81151 | 15 | 9'92971 | 25 | 10'07029 | 9'88180 | 11 | 37 |
| 24 | 9'81166 | 14 | 9'92996 | 26 | 10'07004 | 9'88169 | 11 | 36 |
| 25 | 9'81180 | 15 | 9'93022 | 26 | 10'06978 | 9'88158 | 11 | 35 |
| 26 | 9'81195 | 15 | 9'93048 | 25 | 10'06952 | 9'88148 | 10 | 34 |
| 27 | 9'81210 | 15 | 9'93073 | 26 | 10'06927 | 9'88137 | 11 | 33 |
| 28 | 9'81225 | 15 | 9'93099 | 25 | 10'06901 | 9'88126 | 11 | 32 |
| 29 | 9'81240 | 14 | 9'93124 | 26 | 10'06876 | 9'88115 | 11 | 31 |
| 30 | 9'81254 | | 9'93150 | | 10'06850 | 9'88105 | 10 | 30 |
| | Cosine. | Cotang. | Tangent. | Sine. | | | | |

[49 degrees.]

[40 degrees.]

| | Sine. | Diff. | Tangent. | Diff. | Cotang. | Cosine. | Diff. | |
|----|---------|---------|----------|-------|----------|---------|-------|----|
| 30 | 9'81254 | 15 | 9'93150 | 25 | 10'06850 | 9'88105 | 11 | 30 |
| 31 | 9'81269 | 15 | 9'93175 | 26 | 10'06825 | 9'88094 | 11 | 29 |
| 32 | 9'81284 | 15 | 9'93201 | 26 | 10'06799 | 9'88083 | 11 | 28 |
| 33 | 9'81299 | 15 | 9'93227 | 25 | 10'06773 | 9'88072 | 11 | 27 |
| 34 | 9'81314 | 14 | 9'93252 | 26 | 10'06748 | 9'88061 | 10 | 26 |
| 35 | 9'81328 | 15 | 9'93278 | 25 | 10'06722 | 9'88051 | 11 | 25 |
| 36 | 9'81343 | 15 | 9'93303 | 26 | 10'06697 | 9'88040 | 11 | 24 |
| 37 | 9'81358 | 14 | 9'93329 | 25 | 10'06671 | 9'88029 | 11 | 23 |
| 38 | 9'81372 | 15 | 9'93354 | 26 | 10'06646 | 9'88018 | 11 | 22 |
| 39 | 9'81387 | 15 | 9'93380 | 26 | 10'06620 | 9'88007 | 11 | 21 |
| 40 | 9'81402 | 15 | 9'93406 | 25 | 10'06594 | 9'87996 | 11 | 20 |
| 41 | 9'81417 | 14 | 9'93431 | 26 | 10'06569 | 9'87985 | 11 | 19 |
| 42 | 9'81431 | 15 | 9'93457 | 25 | 10'06543 | 9'87975 | 11 | 18 |
| 43 | 9'81446 | 15 | 9'93482 | 26 | 10'06518 | 9'87964 | 11 | 17 |
| 44 | 9'81461 | 14 | 9'93508 | 25 | 10'06492 | 9'87953 | 11 | 16 |
| 45 | 9'81475 | 15 | 9'93533 | 26 | 10'06467 | 9'87942 | 11 | 15 |
| 46 | 9'81490 | 15 | 9'93559 | 25 | 10'06441 | 9'87931 | 11 | 14 |
| 47 | 9'81505 | 14 | 9'93584 | 26 | 10'06416 | 9'87920 | 11 | 13 |
| 48 | 9'81519 | 15 | 9'93610 | 26 | 10'06390 | 9'87909 | 11 | 12 |
| 49 | 9'81534 | 15 | 9'93636 | 25 | 10'06364 | 9'87898 | 11 | 11 |
| 50 | 9'81549 | 14 | 9'93661 | 26 | 10'06339 | 9'87887 | 10 | 10 |
| 51 | 9'81563 | 15 | 9'93687 | 25 | 10'06313 | 9'87877 | 11 | 9 |
| 52 | 9'81578 | 14 | 9'93712 | 26 | 10'06288 | 9'87866 | 11 | 8 |
| 53 | 9'81592 | 15 | 9'93738 | 25 | 10'06262 | 9'87855 | 11 | 7 |
| 54 | 9'81607 | 15 | 9'93763 | 26 | 10'06237 | 9'87844 | 11 | 6 |
| 55 | 9'81622 | 14 | 9'93789 | 25 | 10'06211 | 9'87833 | 11 | 5 |
| 56 | 9'81636 | 15 | 9'93814 | 26 | 10'06186 | 9'87822 | 11 | 4 |
| 57 | 9'81651 | 14 | 9'93840 | 25 | 10'06160 | 9'87811 | 11 | 3 |
| 58 | 9'81665 | 15 | 9'93865 | 26 | 10'06135 | 9'87800 | 11 | 2 |
| 59 | 9'81680 | 14 | 9'93891 | 25 | 10'06109 | 9'87789 | 11 | 1 |
| 60 | 9'81694 | | 9'93916 | | 10'06084 | 9'87778 | 11 | 0 |
| | Cosine. | Cotang. | Tangent. | Sine. | | | | |

[49 degrees.]

[41 degrees.]

| | Sine. | Diff. | Tangent. | Diff. | Cotang. | Diff. | Cosine. | Diff. | |
|----|---------|-------|----------|-------|----------|-------|---------|-------|----|
| 30 | 9.82126 | 15 | 9.94581 | 25 | 10.05319 | 12 | 9.87446 | 12 | 30 |
| 31 | 9.82141 | 14 | 9.94706 | 25 | 10.05294 | 11 | 9.87434 | 11 | 29 |
| 32 | 9.82155 | 14 | 9.94732 | 25 | 10.05268 | 11 | 9.87423 | 11 | 28 |
| 33 | 9.82169 | 15 | 9.94757 | 26 | 10.05243 | 11 | 9.87412 | 11 | 27 |
| 34 | 9.82184 | 14 | 9.94783 | 25 | 10.05217 | 11 | 9.87401 | 11 | 26 |
| 35 | 9.82198 | 14 | 9.94808 | 25 | 10.05192 | 12 | 9.87390 | 12 | 25 |
| 36 | 9.82212 | 14 | 9.94834 | 26 | 10.05166 | 12 | 9.87378 | 12 | 24 |
| 37 | 9.82226 | 14 | 9.94859 | 25 | 10.05141 | 11 | 9.87367 | 11 | 23 |
| 38 | 9.82240 | 15 | 9.94884 | 26 | 10.05116 | 11 | 9.87356 | 11 | 22 |
| 39 | 9.82255 | 14 | 9.94910 | 25 | 10.05090 | 11 | 9.87345 | 11 | 21 |
| 40 | 9.82269 | 14 | 9.94935 | 26 | 10.05065 | 12 | 9.87334 | 12 | 20 |
| 41 | 9.82283 | 14 | 9.94961 | 25 | 10.05039 | 11 | 9.87322 | 11 | 19 |
| 42 | 9.82297 | 14 | 9.94986 | 26 | 10.05014 | 11 | 9.87311 | 11 | 18 |
| 43 | 9.82311 | 15 | 9.95012 | 25 | 10.04988 | 12 | 9.87300 | 12 | 17 |
| 44 | 9.82326 | 14 | 9.95037 | 25 | 10.04963 | 11 | 9.87288 | 11 | 16 |
| 45 | 9.82340 | 14 | 9.95062 | 26 | 10.04938 | 11 | 9.87277 | 11 | 15 |
| 46 | 9.82354 | 14 | 9.95088 | 25 | 10.04912 | 11 | 9.87266 | 11 | 14 |
| 47 | 9.82368 | 14 | 9.95113 | 26 | 10.04887 | 12 | 9.87255 | 12 | 13 |
| 48 | 9.82382 | 14 | 9.95139 | 25 | 10.04861 | 11 | 9.87243 | 11 | 12 |
| 49 | 9.82396 | 14 | 9.95164 | 26 | 10.04836 | 11 | 9.87232 | 11 | 11 |
| 50 | 9.82410 | 14 | 9.95190 | 25 | 10.04810 | 12 | 9.87221 | 12 | 10 |
| 51 | 9.82424 | 15 | 9.95215 | 25 | 10.04785 | 11 | 9.87209 | 11 | 9 |
| 52 | 9.82439 | 14 | 9.95240 | 26 | 10.04760 | 11 | 9.87198 | 11 | 8 |
| 53 | 9.82453 | 14 | 9.95266 | 25 | 10.04734 | 12 | 9.87187 | 12 | 7 |
| 54 | 9.82467 | 14 | 9.95291 | 26 | 10.04709 | 11 | 9.87175 | 11 | 6 |
| 55 | 9.82481 | 14 | 9.95317 | 25 | 10.04683 | 11 | 9.87164 | 11 | 5 |
| 56 | 9.82495 | 14 | 9.95342 | 26 | 10.04658 | 12 | 9.87153 | 12 | 4 |
| 57 | 9.82509 | 14 | 9.95368 | 25 | 10.04632 | 11 | 9.87141 | 11 | 3 |
| 58 | 9.82523 | 14 | 9.95393 | 25 | 10.04607 | 11 | 9.87130 | 11 | 2 |
| 59 | 9.82537 | 14 | 9.95418 | 26 | 10.04582 | 12 | 9.87119 | 12 | 1 |
| 60 | 9.82551 | 14 | 9.95444 | 26 | 10.04556 | 12 | 9.87107 | 12 | 0 |
| | Cosine. | | Cotang. | | Tangent. | | Sine. | | |

[48 degrees.]

[41 degrees.]

| | Sine. | Diff. | Tangent. | Diff. | Cotang. | Diff. | Cosine. | Diff. | |
|----|---------|-------|----------|-------|----------|-------|---------|-------|----|
| 0 | 9.81694 | 15 | 9.93916 | 26 | 10.06084 | 11 | 9.87778 | 11 | 60 |
| 1 | 9.81709 | 14 | 9.93942 | 25 | 10.06058 | 11 | 9.87767 | 11 | 59 |
| 2 | 9.81723 | 15 | 9.93967 | 26 | 10.06033 | 11 | 9.87756 | 11 | 58 |
| 3 | 9.81738 | 14 | 9.93993 | 25 | 10.06007 | 11 | 9.87745 | 11 | 57 |
| 4 | 9.81752 | 14 | 9.94018 | 26 | 10.05982 | 11 | 9.87734 | 11 | 56 |
| 5 | 9.81767 | 14 | 9.94044 | 25 | 10.05956 | 11 | 9.87723 | 11 | 55 |
| 6 | 9.81781 | 15 | 9.94069 | 26 | 10.05931 | 11 | 9.87712 | 11 | 54 |
| 7 | 9.81796 | 14 | 9.94095 | 25 | 10.05905 | 11 | 9.87701 | 11 | 53 |
| 8 | 9.81810 | 14 | 9.94120 | 26 | 10.05880 | 11 | 9.87690 | 11 | 52 |
| 9 | 9.81825 | 14 | 9.94146 | 25 | 10.05854 | 11 | 9.87679 | 11 | 51 |
| 10 | 9.81839 | 15 | 9.94171 | 26 | 10.05829 | 11 | 9.87668 | 11 | 50 |
| 11 | 9.81854 | 14 | 9.94197 | 25 | 10.05803 | 11 | 9.87657 | 11 | 49 |
| 12 | 9.81868 | 14 | 9.94222 | 26 | 10.05778 | 11 | 9.87646 | 11 | 48 |
| 13 | 9.81882 | 15 | 9.94248 | 25 | 10.05752 | 11 | 9.87635 | 11 | 47 |
| 14 | 9.81897 | 14 | 9.94273 | 26 | 10.05727 | 11 | 9.87624 | 11 | 46 |
| 15 | 9.81911 | 15 | 9.94299 | 25 | 10.05701 | 11 | 9.87613 | 11 | 45 |
| 16 | 9.81926 | 14 | 9.94324 | 26 | 10.05676 | 11 | 9.87601 | 11 | 44 |
| 17 | 9.81940 | 14 | 9.94350 | 25 | 10.05650 | 11 | 9.87590 | 11 | 43 |
| 18 | 9.81955 | 14 | 9.94375 | 26 | 10.05625 | 11 | 9.87579 | 11 | 42 |
| 19 | 9.81969 | 14 | 9.94401 | 25 | 10.05599 | 11 | 9.87568 | 11 | 41 |
| 20 | 9.81983 | 15 | 9.94426 | 26 | 10.05574 | 11 | 9.87557 | 11 | 40 |
| 21 | 9.81998 | 14 | 9.94452 | 25 | 10.05548 | 11 | 9.87546 | 11 | 39 |
| 22 | 9.82012 | 14 | 9.94477 | 26 | 10.05523 | 11 | 9.87535 | 11 | 38 |
| 23 | 9.82026 | 15 | 9.94503 | 25 | 10.05497 | 11 | 9.87524 | 11 | 37 |
| 24 | 9.82041 | 14 | 9.94528 | 26 | 10.05472 | 11 | 9.87513 | 11 | 36 |
| 25 | 9.82055 | 14 | 9.94554 | 25 | 10.05446 | 11 | 9.87501 | 11 | 35 |
| 26 | 9.82069 | 15 | 9.94579 | 26 | 10.05421 | 11 | 9.87490 | 11 | 34 |
| 27 | 9.82084 | 14 | 9.94604 | 25 | 10.05396 | 11 | 9.87479 | 11 | 33 |
| 28 | 9.82098 | 14 | 9.94630 | 26 | 10.05370 | 11 | 9.87468 | 11 | 32 |
| 29 | 9.82112 | 14 | 9.94655 | 25 | 10.05345 | 11 | 9.87457 | 11 | 31 |
| 30 | 9.82126 | 14 | 9.94681 | 26 | 10.05319 | 11 | 9.87446 | 11 | 30 |
| | Cosine. | | Cotang. | | Tangent. | | Sine. | | |

[48 degrees.]

[42 degrees.]

| ' | Sine. | Diff. | Tangent. | Diff. | Cotang. | Cosine. | Diff. | ' |
|----|---------|-------|----------|-------|----------|---------|-------|----|
| 30 | 9.82958 | 14 | 9.96205 | 26 | 10.03795 | 9.86763 | 11 | 30 |
| 31 | 9.82982 | 14 | 9.96231 | 25 | 10.03769 | 9.86752 | 12 | 29 |
| 32 | 9.82996 | 14 | 9.96256 | 25 | 10.03744 | 9.86740 | 12 | 28 |
| 33 | 9.83010 | 14 | 9.96281 | 26 | 10.03719 | 9.86728 | 11 | 27 |
| 34 | 9.83023 | 13 | 9.96307 | 25 | 10.03693 | 9.86717 | 12 | 26 |
| 35 | 9.83037 | 14 | 9.96332 | 25 | 10.03668 | 9.86705 | 11 | 25 |
| 36 | 9.83051 | 14 | 9.96357 | 26 | 10.03643 | 9.86694 | 12 | 24 |
| 37 | 9.83065 | 13 | 9.96383 | 25 | 10.03617 | 9.86682 | 12 | 23 |
| 38 | 9.83078 | 14 | 9.96408 | 25 | 10.03592 | 9.86670 | 11 | 22 |
| 39 | 9.83092 | 14 | 9.96433 | 26 | 10.03567 | 9.86659 | 12 | 21 |
| 40 | 9.83106 | 14 | 9.96459 | 25 | 10.03541 | 9.86647 | 12 | 20 |
| 41 | 9.83120 | 13 | 9.96484 | 26 | 10.03516 | 9.86635 | 11 | 19 |
| 42 | 9.83133 | 14 | 9.96510 | 25 | 10.03490 | 9.86624 | 12 | 18 |
| 43 | 9.83147 | 14 | 9.96535 | 25 | 10.03465 | 9.86612 | 12 | 17 |
| 44 | 9.83161 | 13 | 9.96560 | 26 | 10.03440 | 9.86600 | 11 | 16 |
| 45 | 9.83174 | 14 | 9.96586 | 25 | 10.03414 | 9.86589 | 12 | 15 |
| 46 | 9.83188 | 14 | 9.96611 | 25 | 10.03389 | 9.86577 | 12 | 14 |
| 47 | 9.83202 | 13 | 9.96636 | 26 | 10.03364 | 9.86565 | 11 | 13 |
| 48 | 9.83215 | 14 | 9.96662 | 25 | 10.03338 | 9.86554 | 12 | 12 |
| 49 | 9.83229 | 13 | 9.96687 | 25 | 10.03313 | 9.86542 | 12 | 11 |
| 50 | 9.83242 | 14 | 9.96712 | 26 | 10.03288 | 9.86530 | 12 | 10 |
| 51 | 9.83256 | 14 | 9.96738 | 25 | 10.03262 | 9.86518 | 11 | 9 |
| 52 | 9.83270 | 13 | 9.96763 | 25 | 10.03237 | 9.86507 | 12 | 8 |
| 53 | 9.83283 | 14 | 9.96788 | 26 | 10.03212 | 9.86495 | 12 | 7 |
| 54 | 9.83297 | 13 | 9.96814 | 25 | 10.03186 | 9.86483 | 11 | 6 |
| 55 | 9.83310 | 14 | 9.96839 | 25 | 10.03161 | 9.86472 | 12 | 5 |
| 56 | 9.83324 | 14 | 9.96864 | 26 | 10.03136 | 9.86460 | 12 | 4 |
| 57 | 9.83338 | 13 | 9.96890 | 25 | 10.03110 | 9.86448 | 12 | 3 |
| 58 | 9.83351 | 14 | 9.96915 | 25 | 10.03085 | 9.86436 | 11 | 2 |
| 59 | 9.83365 | 13 | 9.96940 | 26 | 10.03060 | 9.86425 | 12 | 1 |
| 60 | 9.83378 | | 9.96966 | | 10.03034 | 9.86413 | 12 | 0 |
| | | | Cotang. | | Tangent. | Sine. | | |

[47 degrees.]

[42 degrees.]

| ' | Sine. | Diff. | Tangent. | Diff. | Cotang. | Diff. | Cosine. | Diff. | ' |
|----|---------|-------|----------|-------|----------|---------|---------|-------|---|
| 0 | 9.82551 | 14 | 9.95444 | 25 | 10.04556 | 9.87107 | 11 | 60 | |
| 1 | 9.82565 | 14 | 9.95469 | 26 | 10.04531 | 9.87096 | 11 | 59 | |
| 2 | 9.82579 | 14 | 9.95495 | 25 | 10.04505 | 9.87085 | 12 | 58 | |
| 3 | 9.82593 | 14 | 9.95520 | 25 | 10.04480 | 9.87073 | 11 | 57 | |
| 4 | 9.82607 | 14 | 9.95545 | 26 | 10.04455 | 9.87062 | 12 | 56 | |
| 5 | 9.82621 | 14 | 9.95571 | 25 | 10.04429 | 9.87050 | 11 | 55 | |
| 6 | 9.82635 | 14 | 9.95596 | 26 | 10.04404 | 9.87039 | 11 | 54 | |
| 7 | 9.82649 | 14 | 9.95622 | 25 | 10.04378 | 9.87028 | 12 | 53 | |
| 8 | 9.82663 | 14 | 9.95647 | 25 | 10.04353 | 9.87016 | 11 | 52 | |
| 9 | 9.82677 | 14 | 9.95672 | 26 | 10.04328 | 9.87005 | 12 | 51 | |
| 10 | 9.82691 | 14 | 9.95698 | 25 | 10.04302 | 9.86993 | 11 | 50 | |
| 11 | 9.82705 | 14 | 9.95723 | 25 | 10.04277 | 9.86982 | 12 | 49 | |
| 12 | 9.82719 | 14 | 9.95748 | 26 | 10.04252 | 9.86970 | 11 | 48 | |
| 13 | 9.82733 | 14 | 9.95774 | 25 | 10.04226 | 9.86959 | 12 | 47 | |
| 14 | 9.82747 | 14 | 9.95799 | 26 | 10.04201 | 9.86947 | 11 | 46 | |
| 15 | 9.82761 | 14 | 9.95825 | 25 | 10.04175 | 9.86936 | 12 | 45 | |
| 16 | 9.82775 | 13 | 9.95850 | 25 | 10.04150 | 9.86924 | 11 | 44 | |
| 17 | 9.82788 | 14 | 9.95875 | 26 | 10.04125 | 9.86913 | 11 | 43 | |
| 18 | 9.82802 | 14 | 9.95901 | 25 | 10.04099 | 9.86902 | 12 | 42 | |
| 19 | 9.82816 | 14 | 9.95926 | 26 | 10.04074 | 9.86890 | 11 | 41 | |
| 20 | 9.82830 | 14 | 9.95952 | 25 | 10.04048 | 9.86879 | 12 | 40 | |
| 21 | 9.82844 | 14 | 9.95977 | 25 | 10.04023 | 9.86867 | 12 | 39 | |
| 22 | 9.82858 | 14 | 9.96002 | 26 | 10.03998 | 9.86855 | 11 | 38 | |
| 23 | 9.82872 | 13 | 9.96028 | 25 | 10.03972 | 9.86844 | 12 | 37 | |
| 24 | 9.82885 | 14 | 9.96053 | 25 | 10.03947 | 9.86832 | 11 | 36 | |
| 25 | 9.82899 | 14 | 9.96078 | 26 | 10.03922 | 9.86821 | 12 | 35 | |
| 26 | 9.82913 | 14 | 9.96104 | 25 | 10.03896 | 9.86809 | 11 | 34 | |
| 27 | 9.82927 | 14 | 9.96129 | 26 | 10.03871 | 9.86798 | 12 | 33 | |
| 28 | 9.82941 | 14 | 9.96155 | 25 | 10.03845 | 9.86786 | 11 | 32 | |
| 29 | 9.82955 | 14 | 9.96180 | 25 | 10.03820 | 9.86775 | 12 | 31 | |
| 30 | 9.82968 | 13 | 9.96205 | 25 | 10.03795 | 9.86763 | 12 | 30 | |
| ' | Cosine. | | Cotang. | | Tangent. | Sine. | | ' | |

[47 degrees.]

[43 degrees.]

| ' | Sine. | Diff. | Tangent. | Diff. | Cotang. | Cosine. | Diff. | ' |
|----|---------|-------|----------|-------|----------|---------|-------|----|
| 0 | 9.83378 | 14 | 9.96966 | 25 | 10.03034 | 9.86413 | 12 | 60 |
| 1 | 9.83392 | 13 | 9.96991 | 25 | 10.03009 | 9.86401 | 12 | 59 |
| 2 | 9.83405 | 14 | 9.97016 | 26 | 10.02984 | 9.86389 | 12 | 58 |
| 3 | 9.83419 | 14 | 9.97042 | 25 | 10.02958 | 9.86377 | 11 | 57 |
| 4 | 9.83432 | 14 | 9.97067 | 25 | 10.02933 | 9.86366 | 12 | 56 |
| 5 | 9.83446 | 13 | 9.97092 | 26 | 10.02908 | 9.86354 | 12 | 55 |
| 6 | 9.83459 | 13 | 9.97118 | 25 | 10.02882 | 9.86342 | 12 | 54 |
| 7 | 9.83472 | 14 | 9.97143 | 25 | 10.02857 | 9.86330 | 12 | 53 |
| 8 | 9.83486 | 14 | 9.97168 | 25 | 10.02832 | 9.86318 | 12 | 52 |
| 9 | 9.83500 | 13 | 9.97193 | 26 | 10.02807 | 9.86306 | 11 | 51 |
| 10 | 9.83513 | 14 | 9.97219 | 25 | 10.02781 | 9.86295 | 12 | 50 |
| 11 | 9.83527 | 13 | 9.97244 | 25 | 10.02756 | 9.86283 | 12 | 49 |
| 12 | 9.83540 | 14 | 9.97269 | 26 | 10.02731 | 9.86271 | 12 | 48 |
| 13 | 9.83554 | 13 | 9.97295 | 25 | 10.02705 | 9.86259 | 12 | 47 |
| 14 | 9.83567 | 14 | 9.97320 | 25 | 10.02680 | 9.86247 | 12 | 46 |
| 15 | 9.83581 | 13 | 9.97345 | 26 | 10.02655 | 9.86235 | 12 | 45 |
| 16 | 9.83594 | 14 | 9.97371 | 25 | 10.02629 | 9.86223 | 12 | 44 |
| 17 | 9.83608 | 13 | 9.97396 | 25 | 10.02604 | 9.86211 | 11 | 43 |
| 18 | 9.83621 | 13 | 9.97421 | 26 | 10.02579 | 9.86200 | 12 | 42 |
| 19 | 9.83634 | 14 | 9.97447 | 25 | 10.02553 | 9.86188 | 12 | 41 |
| 20 | 9.83648 | 13 | 9.97472 | 25 | 10.02528 | 9.86176 | 12 | 40 |
| 21 | 9.83661 | 13 | 9.97497 | 26 | 10.02503 | 9.86164 | 12 | 39 |
| 22 | 9.83674 | 14 | 9.97523 | 25 | 10.02477 | 9.86152 | 12 | 38 |
| 23 | 9.83688 | 13 | 9.97548 | 25 | 10.02452 | 9.86140 | 12 | 37 |
| 24 | 9.83701 | 14 | 9.97573 | 25 | 10.02427 | 9.86128 | 12 | 36 |
| 25 | 9.83715 | 13 | 9.97598 | 26 | 10.02402 | 9.86116 | 12 | 35 |
| 26 | 9.83728 | 13 | 9.97624 | 25 | 10.02376 | 9.86104 | 12 | 34 |
| 27 | 9.83741 | 14 | 9.97649 | 25 | 10.02351 | 9.86092 | 12 | 33 |
| 28 | 9.83755 | 13 | 9.97674 | 26 | 10.02326 | 9.86080 | 12 | 32 |
| 29 | 9.83768 | 13 | 9.97700 | 25 | 10.02300 | 9.86068 | 12 | 31 |
| 30 | 9.83781 | 13 | 9.97725 | 25 | 10.02275 | 9.86056 | 12 | 30 |
| ' | Cosine. | | Cotang. | | Tangent. | Sine. | | ' |

[46 degrees.]

[43 degrees.]

| ' | Sine. | Diff. | Tangent. | Diff. | Cotang. | Cosine. | Diff. | ' |
|----|---------|-------|----------|-------|----------|---------|-------|----|
| 30 | 9.83781 | 14 | 9.97755 | 25 | 10.02275 | 9.86056 | 12 | 30 |
| 29 | 9.83795 | 13 | 9.97759 | 26 | 10.02250 | 9.86044 | 12 | 29 |
| 28 | 9.83808 | 13 | 9.97776 | 25 | 10.02224 | 9.86032 | 12 | 28 |
| 27 | 9.83821 | 13 | 9.97801 | 25 | 10.02199 | 9.86020 | 12 | 27 |
| 26 | 9.83834 | 14 | 9.97826 | 25 | 10.02174 | 9.86008 | 12 | 26 |
| 25 | 9.83848 | 13 | 9.97851 | 26 | 10.02149 | 9.85996 | 12 | 25 |
| 24 | 9.83861 | 13 | 9.97877 | 25 | 10.02123 | 9.85984 | 12 | 24 |
| 23 | 9.83874 | 14 | 9.97902 | 25 | 10.02098 | 9.85972 | 12 | 23 |
| 22 | 9.83887 | 13 | 9.97927 | 26 | 10.02073 | 9.85960 | 12 | 22 |
| 21 | 9.83901 | 13 | 9.97953 | 25 | 10.02047 | 9.85948 | 12 | 21 |
| 20 | 9.83914 | 13 | 9.97978 | 25 | 10.02022 | 9.85936 | 12 | 20 |
| 19 | 9.83927 | 13 | 9.98003 | 26 | 10.01997 | 9.85924 | 12 | 19 |
| 18 | 9.83940 | 14 | 9.98029 | 25 | 10.01971 | 9.85912 | 12 | 18 |
| 17 | 9.83954 | 13 | 9.98054 | 25 | 10.01946 | 9.85900 | 12 | 17 |
| 16 | 9.83967 | 13 | 9.98079 | 25 | 10.01921 | 9.85888 | 12 | 16 |
| 15 | 9.83980 | 13 | 9.98104 | 26 | 10.01896 | 9.85876 | 12 | 15 |
| 14 | 9.83993 | 13 | 9.98130 | 25 | 10.01870 | 9.85864 | 12 | 14 |
| 13 | 9.84006 | 14 | 9.98155 | 25 | 10.01845 | 9.85851 | 12 | 13 |
| 12 | 9.84020 | 13 | 9.98180 | 26 | 10.01820 | 9.85839 | 12 | 12 |
| 11 | 9.84032 | 13 | 9.98206 | 25 | 10.01794 | 9.85827 | 12 | 11 |
| 10 | 9.84046 | 13 | 9.98231 | 25 | 10.01769 | 9.85815 | 12 | 10 |
| 9 | 9.84059 | 13 | 9.98256 | 25 | 10.01744 | 9.85803 | 12 | 9 |
| 8 | 9.84072 | 13 | 9.98281 | 26 | 10.01719 | 9.85791 | 12 | 8 |
| 7 | 9.84085 | 13 | 9.98307 | 25 | 10.01693 | 9.85779 | 12 | 7 |
| 6 | 9.84098 | 14 | 9.98332 | 25 | 10.01668 | 9.85766 | 12 | 6 |
| 5 | 9.84112 | 13 | 9.98357 | 26 | 10.01643 | 9.85754 | 12 | 5 |
| 4 | 9.84125 | 13 | 9.98383 | 25 | 10.01617 | 9.85742 | 12 | 4 |
| 3 | 9.84138 | 13 | 9.98408 | 25 | 10.01592 | 9.85730 | 12 | 3 |
| 2 | 9.84151 | 13 | 9.98433 | 25 | 10.01567 | 9.85718 | 12 | 2 |
| 1 | 9.84164 | 13 | 9.98458 | 26 | 10.01542 | 9.85706 | 12 | 1 |
| 0 | 9.84177 | 13 | 9.98484 | 25 | 10.01516 | 9.85693 | 12 | 0 |
| ' | Cosine. | | Cotang. | | Tangent. | Sine. | | ' |

[46 degrees.]

[44 degrees.]

| | Sine. | Diff. | Tangent. | Diff. | Cotang. | Cosine. | Diff. |
|----|---------|-------|----------|-------|----------|---------|-------|
| 30 | 9'84566 | 13 | 9'99242 | 25 | 10'00738 | 9'85324 | 12 |
| 31 | 9'84579 | 13 | 9'99247 | 25 | 10'00733 | 9'85312 | 12 |
| 32 | 9'84592 | 13 | 9'99251 | 25 | 10'00707 | 9'85299 | 13 |
| 33 | 9'84605 | 13 | 9'99318 | 25 | 10'00682 | 9'85287 | 13 |
| 34 | 9'84618 | 12 | 9'99343 | 25 | 10'00657 | 9'85274 | 13 |
| 35 | 9'84631 | 12 | 9'99368 | 25 | 10'00632 | 9'85262 | 12 |
| 36 | 9'84643 | 13 | 9'99394 | 25 | 10'00606 | 9'85250 | 12 |
| 37 | 9'84656 | 13 | 9'99419 | 25 | 10'00581 | 9'85237 | 13 |
| 38 | 9'84669 | 13 | 9'99444 | 25 | 10'00556 | 9'85225 | 13 |
| 39 | 9'84682 | 12 | 9'99469 | 26 | 10'00531 | 9'85212 | 12 |
| 40 | 9'84694 | 12 | 9'99495 | 25 | 10'00505 | 9'85200 | 12 |
| 41 | 9'84707 | 13 | 9'99520 | 25 | 10'00480 | 9'85187 | 13 |
| 42 | 9'84720 | 13 | 9'99545 | 25 | 10'00455 | 9'85175 | 13 |
| 43 | 9'84733 | 12 | 9'99570 | 26 | 10'00430 | 9'85162 | 12 |
| 44 | 9'84745 | 13 | 9'99596 | 25 | 10'00404 | 9'85150 | 13 |
| 45 | 9'84758 | 13 | 9'99621 | 25 | 10'00379 | 9'85137 | 12 |
| 46 | 9'84771 | 13 | 9'99646 | 26 | 10'00354 | 9'85125 | 13 |
| 47 | 9'84784 | 12 | 9'99672 | 25 | 10'00328 | 9'85112 | 12 |
| 48 | 9'84796 | 13 | 9'99697 | 25 | 10'00303 | 9'85100 | 13 |
| 49 | 9'84809 | 13 | 9'99722 | 25 | 10'00278 | 9'85087 | 13 |
| 50 | 9'84822 | 13 | 9'99747 | 26 | 10'00253 | 9'85074 | 12 |
| 51 | 9'84835 | 12 | 9'99773 | 25 | 10'00227 | 9'85062 | 13 |
| 52 | 9'84847 | 13 | 9'99798 | 25 | 10'00202 | 9'85050 | 12 |
| 53 | 9'84860 | 13 | 9'99823 | 25 | 10'00177 | 9'85037 | 13 |
| 54 | 9'84873 | 12 | 9'99848 | 26 | 10'00152 | 9'85024 | 12 |
| 55 | 9'84885 | 13 | 9'99874 | 25 | 10'00126 | 9'85012 | 13 |
| 56 | 9'84898 | 13 | 9'99899 | 25 | 10'00101 | 9'84999 | 13 |
| 57 | 9'84911 | 12 | 9'99924 | 25 | 10'00076 | 9'84986 | 12 |
| 58 | 9'84923 | 13 | 9'99949 | 26 | 10'00051 | 9'84974 | 13 |
| 59 | 9'84936 | 13 | 9'99975 | 25 | 10'00025 | 9'84961 | 13 |
| 60 | 9'84949 | 13 | 10'00000 | 25 | 10'00000 | 9'84949 | 12 |
| | | | Cotang. | | Tangent. | Sine. | |

[45 degrees.]

| | Slue. | Diff. | Tangent. | Diff. | Colang. | Conne. | Diff. | |
|----|---------|-------|----------|-------|----------|---------|-------|----|
| 0 | 9°8'177 | 13 | 9°98484 | 25 | 10°01516 | 9°84693 | 12 | 60 |
| 1 | 9°84190 | 13 | 9°98509 | 25 | 10°01491 | 9°84681 | 12 | 59 |
| 2 | 9°84203 | 13 | 9°98534 | 25 | 10°01466 | 9°84669 | 12 | 58 |
| 3 | 9°84216 | 13 | 9°98560 | 26 | 10°01440 | 9°84657 | 12 | 57 |
| 4 | 9°84229 | 13 | 9°98585 | 25 | 10°01415 | 9°84645 | 13 | 56 |
| 5 | 9°84242 | 13 | 9°98610 | 25 | 10°01390 | 9°84632 | 12 | 55 |
| 6 | 9°84255 | 14 | 9°98635 | 26 | 10°01365 | 9°84620 | 12 | 54 |
| 7 | 9°84269 | 13 | 9°98661 | 25 | 10°01339 | 9°84608 | 12 | 53 |
| 8 | 9°84282 | 13 | 9°98686 | 25 | 10°01314 | 9°84596 | 13 | 52 |
| 9 | 9°84295 | 13 | 9°98711 | 26 | 10°01289 | 9°84583 | 12 | 51 |
| 10 | 9°84308 | 13 | 9°98737 | 25 | 10°01263 | 9°84571 | 12 | 50 |
| 11 | 9°84321 | 13 | 9°98762 | 25 | 10°01238 | 9°84559 | 12 | 49 |
| 12 | 9°84334 | 13 | 9°98787 | 25 | 10°01213 | 9°84547 | 13 | 48 |
| 13 | 9°84347 | 13 | 9°98812 | 26 | 10°01188 | 9°84534 | 12 | 47 |
| 14 | 9°84360 | 13 | 9°98838 | 25 | 10°01162 | 9°84522 | 12 | 46 |
| 15 | 9°84373 | 12 | 9°98863 | 25 | 10°01137 | 9°84510 | 13 | 45 |
| 16 | 9°84385 | 13 | 9°98888 | 25 | 10°01112 | 9°84497 | 12 | 44 |
| 17 | 9°84398 | 13 | 9°98913 | 26 | 10°01087 | 9°84485 | 12 | 43 |
| 18 | 9°84411 | 13 | 9°98939 | 25 | 10°01061 | 9°84473 | 12 | 42 |
| 19 | 9°84424 | 13 | 9°98964 | 25 | 10°01036 | 9°84460 | 13 | 41 |
| 20 | 9°84437 | 13 | 9°98989 | 26 | 10°01011 | 9°84448 | 12 | 40 |
| 21 | 9°84450 | 13 | 9°99015 | 25 | 10°00986 | 9°84436 | 13 | 39 |
| 22 | 9°84463 | 13 | 9°99040 | 25 | 10°00960 | 9°84423 | 12 | 38 |
| 23 | 9°84476 | 13 | 9°99065 | 25 | 10°00935 | 9°84411 | 12 | 37 |
| 24 | 9°84489 | 13 | 9°99090 | 26 | 10°00910 | 9°84399 | 13 | 36 |
| 25 | 9°84502 | 13 | 9°99116 | 25 | 10°00884 | 9°84386 | 12 | 35 |
| 26 | 9°84515 | 13 | 9°99141 | 25 | 10°00859 | 9°84374 | 13 | 34 |
| 27 | 9°84528 | 13 | 9°99166 | 25 | 10°00834 | 9°84361 | 12 | 33 |
| 28 | 9°84540 | 12 | 9°99191 | 26 | 10°00809 | 9°84349 | 12 | 32 |
| 29 | 9°84553 | 13 | 9°99217 | 25 | 10°00783 | 9°84337 | 13 | 31 |
| 30 | 9°84566 | | 9°99242 | | 10°00758 | 9°84324 | | 30 |
| | Coline | | Colang. | | Tangent. | Slue. | | |


[45 degrees.]

TABLES OF RIGHT ASCENSION,
DECLINATION, AND ASCENSIONAL
DIFFERENCE


| ARIES AND LIBRA | | | | ASCENSIONAL DIFFERENCE | | | | | | |
|-----------------|---------|----|------------|------------------------|--------|----|-----------|----|-----------|----|
| Deg. | Declin. | | Rt. Ascen. | | London | | Birming'm | | Liverpool | |
| ° | ° | ' | ° | ' | ° | ' | ° | ' | ° | ' |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 0 | 24 | 0 | 55 | 0 | 30 | 0 | 31 | 0 | 32 |
| 2 | 0 | 48 | 1 | 50 | 1 | 0 | 1 | 2 | 1 | 4 |
| 3 | 1 | 12 | 2 | 45 | 1 | 30 | 1 | 33 | 1 | 37 |
| 4 | 1 | 36 | 3 | 40 | 2 | 0 | 2 | 4 | 2 | 9 |
| 5 | 1 | 59 | 4 | 35 | 2 | 30 | 2 | 35 | 2 | 41 |
| <hr/> | | | | | | | | | | |
| 6 | 2 | 23 | 5 | 30 | 3 | 0 | 3 | 6 | 3 | 13 |
| 7 | 2 | 47 | 6 | 26 | 3 | 30 | 3 | 37 | 3 | 45 |
| 8 | 3 | 10 | 7 | 21 | 4 | 0 | 4 | 8 | 4 | 17 |
| 9 | 3 | 34 | 8 | 16 | 4 | 30 | 4 | 39 | 4 | 49 |
| 10 | 3 | 58 | 9 | 11 | 5 | 0 | 5 | 10 | 5 | 21 |
| <hr/> | | | | | | | | | | |
| 11 | 4 | 21 | 10 | 7 | 5 | 30 | 5 | 41 | 5 | 53 |
| 12 | 4 | 45 | 11 | 2 | 6 | 0 | 6 | 12 | 6 | 25 |
| 13 | 5 | 8 | 11 | 58 | 6 | 30 | 6 | 43 | 6 | 57 |
| 14 | 5 | 31 | 12 | 53 | 7 | 0 | 7 | 14 | 7 | 29 |
| 15 | 5 | 55 | 13 | 49 | 7 | 29 | 7 | 45 | 8 | 1 |
| <hr/> | | | | | | | | | | |
| 16 | 6 | 18 | 14 | 44 | 7 | 59 | 8 | 16 | 8 | 33 |
| 17 | 6 | 41 | 15 | 40 | 8 | 29 | 8 | 46 | 9 | 5 |
| 18 | 7 | 4 | 16 | 36 | 8 | 58 | 9 | 17 | 9 | 37 |
| 19 | 7 | 27 | 17 | 32 | 9 | 28 | 9 | 48 | 10 | 8 |
| 20 | 7 | 49 | 18 | 28 | 9 | 57 | 10 | 18 | 10 | 40 |
| <hr/> | | | | | | | | | | |
| 21 | 8 | 12 | 19 | 24 | 10 | 27 | 10 | 49 | 11 | 12 |
| 22 | 8 | 34 | 20 | 20 | 10 | 56 | 11 | 19 | 11 | 43 |
| 23 | 8 | 57 | 21 | 17 | 11 | 26 | 11 | 49 | 12 | 15 |
| 24 | 9 | 19 | 22 | 13 | 11 | 55 | 12 | 20 | 12 | 46 |
| 25 | 9 | 41 | 23 | 10 | 12 | 24 | 12 | 50 | 13 | 17 |
| <hr/> | | | | | | | | | | |
| 26 | 10 | 3 | 24 | 6 | 12 | 53 | 13 | 20 | 13 | 49 |
| 27 | 10 | 24 | 25 | 3 | 13 | 22 | 13 | 50 | 14 | 20 |
| 28 | 10 | 46 | 26 | 0 | 13 | 51 | 14 | 20 | 14 | 51 |
| 29 | 11 | 7 | 26 | 57 | 14 | 20 | 14 | 50 | 15 | 22 |
| 30 | 11 | 29 | 27 | 55 | 14 | 48 | 15 | 19 | 15 | 53 |

 For the R.A. of Libra add 180° to the same degree of Aries. The Declin. and Asc. Diff. are the same for both.

| TAURUS AND SCORPIO | | | | | ASCENSIONAL DIFFERENCE | | | | | |
|--------------------|---------|----|------------|----|------------------------|----|-----------|----|-----------|----|
| Deg. | Declin. | | Rt. Ascen. | | London | | Birming'm | | Liverpool | |
| ° | ° | ' | ° | ' | ° | ' | ° | ' | ° | ' |
| 0 | 11 | 29 | 27 | 55 | 14 | 48 | 15 | 19 | 15 | 53 |
| 1 | 11 | 50 | 28 | 52 | 15 | 17 | 15 | 49 | 16 | 23 |
| 2 | 12 | 10 | 29 | 49 | 15 | 45 | 16 | 19 | 16 | 54 |
| 3 | 12 | 31 | 30 | 47 | 16 | 14 | 16 | 48 | 17 | 24 |
| 4 | 12 | 51 | 31 | 45 | 16 | 42 | 17 | 17 | 17 | 55 |
| 5 | 13 | 12 | 32 | 43 | 17 | 10 | 17 | 46 | 18 | 25 |
| 6 | 13 | 32 | 33 | 41 | 17 | 38 | 18 | 15 | 18 | 55 |
| 7 | 13 | 51 | 34 | 39 | 18 | 5 | 18 | 44 | 19 | 25 |
| 8 | 14 | 11 | 35 | 38 | 18 | 33 | 19 | 12 | 19 | 54 |
| 9 | 14 | 30 | 36 | 37 | 19 | 0 | 19 | 41 | 20 | 24 |
| 10 | 14 | 49 | 37 | 35 | 19 | 27 | 20 | 9 | 20 | 53 |
| 11 | 15 | 8 | 38 | 34 | 19 | 54 | 20 | 37 | 21 | 22 |
| 12 | 15 | 27 | 39 | 33 | 20 | 21 | 21 | 5 | 21 | 51 |
| 13 | 15 | 45 | 40 | 33 | 20 | 47 | 21 | 32 | 22 | 20 |
| 14 | 16 | 3 | 41 | 32 | 21 | 14 | 21 | 59 | 22 | 48 |
| 15 | 16 | 21 | 42 | 32 | 21 | 40 | 22 | 26 | 23 | 16 |
| 16 | 16 | 38 | 43 | 32 | 22 | 5 | 22 | 53 | 23 | 44 |
| 17 | 16 | 55 | 44 | 32 | 22 | 31 | 23 | 20 | 24 | 12 |
| 18 | 17 | 12 | 45 | 32 | 22 | 56 | 23 | 46 | 24 | 39 |
| 19 | 17 | 29 | 46 | 33 | 23 | 21 | 24 | 12 | 25 | 6 |
| 20 | 17 | 45 | 47 | 33 | 23 | 46 | 24 | 37 | 25 | 33 |
| 21 | 18 | 1 | 48 | 34 | 24 | 10 | 25 | 3 | 25 | 59 |
| 22 | 18 | 17 | 49 | 35 | 24 | 34 | 25 | 28 | 26 | 25 |
| 23 | 18 | 32 | 50 | 36 | 24 | 57 | 25 | 52 | 26 | 51 |
| 24 | 18 | 47 | 51 | 37 | 25 | 21 | 26 | 16 | 27 | 16 |
| 25 | 19 | 1 | 52 | 39 | 25 | 43 | 26 | 40 | 27 | 41 |
| 26 | 19 | 16 | 53 | 40 | 26 | 6 | 27 | 4 | 28 | 5 |
| 27 | 19 | 30 | 54 | 42 | 26 | 28 | 27 | 27 | 28 | 29 |
| 28 | 19 | 43 | 55 | 44 | 26 | 49 | 27 | 49 | 28 | 58 |
| 29 | 19 | 57 | 56 | 47 | 27 | 11 | 28 | 11 | 29 | 16 |
| 30 | 20 | 10 | 57 | 49 | 27 | 31 | 28 | 33 | 29 | 39 |

 For R.A. of Scorpio add 180° to the same degree of Taurus. The Declin. and Asc. Diff. are the same for both.


| GEMINI & SAGITTARIUS | | | | | ASCENSIONAL DIFFERENCE | | | | | | |
|----------------------|----|---------|----|------------|------------------------|--------|----|-----------|----|-----------|---|
| Deg. | | Declin. | | Rt. Ascen. | | London | | Birming'm | | Liverpool | |
| ° | ' | ° | ' | ° | ' | ° | ' | ° | ' | ° | ' |
| 0 | 20 | 10 | 57 | 49 | 27 | 31 | 28 | 33 | 29 | 39 | |
| 1 | 20 | 22 | 58 | 52 | 27 | 52 | 28 | 54 | 30 | 1 | |
| 2 | 20 | 35 | 59 | 54 | 28 | 12 | 29 | 15 | 30 | 23 | |
| 3 | 20 | 46 | 60 | 57 | 28 | 31 | 29 | 35 | 30 | 44 | |
| 4 | 20 | 57 | 62 | 0 | 28 | 49 | 29 | 54 | 31 | 4 | |
| 5 | 21 | 8 | 63 | 3 | 29 | 8 | 30 | 13 | 31 | 24 | |
| 6 | 21 | 19 | 64 | 7 | 29 | 25 | 30 | 32 | 31 | 43 | |
| 7 | 21 | 29 | 65 | 10 | 29 | 42 | 30 | 50 | 32 | 2 | |
| 8 | 21 | 39 | 66 | 14 | 29 | 59 | 31 | 7 | 32 | 20 | |
| 9 | 21 | 49 | 67 | 18 | 30 | 15 | 31 | 23 | 32 | 37 | |
| 10 | 21 | 58 | 68 | 22 | 30 | 30 | 31 | 40 | 32 | 54 | |
| 11 | 22 | 6 | 69 | 26 | 30 | 45 | 31 | 55 | 33 | 10 | |
| 12 | 22 | 14 | 70 | 30 | 30 | 58 | 32 | 9 | 33 | 26 | |
| 13 | 22 | 22 | 71 | 34 | 31 | 11 | 32 | 23 | 33 | 40 | |
| 14 | 22 | 29 | 72 | 39 | 31 | 24 | 32 | 37 | 33 | 54 | |
| 15 | 22 | 36 | 73 | 43 | 31 | 36 | 32 | 49 | 34 | 7 | |
| 16 | 22 | 43 | 74 | 48 | 31 | 48 | 33 | 1 | 34 | 20 | |
| 17 | 22 | 49 | 75 | 52 | 31 | 58 | 33 | 12 | 34 | 31 | |
| 18 | 22 | 55 | 76 | 57 | 32 | 8 | 33 | 22 | 34 | 42 | |
| 19 | 23 | 0 | 78 | 2 | 32 | 17 | 33 | 32 | 34 | 52 | |
| 20 | 23 | 4 | 79 | 7 | 32 | 25 | 33 | 41 | 35 | 1 | |
| 21 | 23 | 9 | 80 | 12 | 32 | 33 | 33 | 49 | 35 | 10 | |
| 22 | 23 | 13 | 81 | 17 | 32 | 40 | 33 | 56 | 35 | 17 | |
| 23 | 23 | 16 | 82 | 22 | 32 | 46 | 34 | 2 | 35 | 24 | |
| 24 | 23 | 19 | 83 | 28 | 32 | 51 | 34 | 7 | 35 | 30 | |
| 25 | 23 | 21 | 84 | 33 | 32 | 55 | 34 | 12 | 35 | 35 | |
| 26 | 23 | 23 | 85 | 38 | 32 | 59 | 34 | 16 | 35 | 39 | |
| 27 | 23 | 25 | 86 | 44 | 33 | 2 | 34 | 19 | 35 | 42 | |
| 28 | 23 | 26 | 87 | 49 | 33 | 4 | 34 | 21 | 35 | 44 | |
| 29 | 23 | 27 | 88 | 55 | 33 | 5 | 34 | 22 | 35 | 45 | |
| 30 | 23 | 27 | 90 | 0 | 33 | 6 | 34 | 23 | 35 | 46 | |

 For the R.A. of Sagittarius add 180° to the same degree of Gemini. The Declin. and Asc. Diff. are the same for both.

| CANCER AND CAPRICORNUS | | | | ASCENSIONAL DIFFERENCE | | | | | | |
|---------------------------|---------|----|------------|------------------------|--------|----|-----------|----|-----------|----|
| Deg. | Declin. | | Rt. Ascen. | | London | | Birming'm | | Liverpool | |
| ° | ° | ' | ° | ' | ° | ' | ° | ' | ° | ' |
| 0 | 23 | 27 | 90 | 0 | 33 | 6 | 34 | 23 | 35 | 46 |
| 1 | 23 | 27 | 91 | 5 | 33 | 5 | 34 | 22 | 35 | 45 |
| 2 | 23 | 26 | 92 | 11 | 33 | 4 | 34 | 21 | 35 | 44 |
| 3 | 23 | 25 | 93 | 16 | 33 | 2 | 34 | 19 | 35 | 42 |
| 4 | 23 | 23 | 94 | 22 | 32 | 59 | 34 | 16 | 35 | 39 |
| 5 | 23 | 21 | 95 | 27 | 32 | 55 | 34 | 12 | 35 | 35 |
| 6 | 23 | 19 | 96 | 32 | 32 | 51 | 34 | 7 | 35 | 30 |
| 7 | 23 | 16 | 97 | 38 | 32 | 46 | 34 | 2 | 35 | 24 |
| 8 | 23 | 13 | 98 | 43 | 32 | 40 | 33 | 56 | 35 | 17 |
| 9 | 23 | 9 | 99 | 48 | 32 | 33 | 33 | 49 | 35 | 10 |
| 10 | 23 | 4 | 100 | 53 | 32 | 25 | 33 | 41 | 35 | 1 |
| 11 | 23 | 0 | 101 | 58 | 32 | 17 | 33 | 32 | 34 | 52 |
| 12 | 22 | 55 | 103 | 3 | 32 | 8 | 33 | 22 | 34 | 42 |
| 13 | 22 | 49 | 104 | 8 | 31 | 58 | 33 | 12 | 34 | 31 |
| 14 | 22 | 43 | 105 | 12 | 31 | 48 | 33 | 1 | 34 | 20 |
| 15 | 22 | 36 | 106 | 17 | 31 | 36 | 32 | 49 | 34 | 7 |
| 16 | 22 | 29 | 107 | 21 | 31 | 24 | 32 | 37 | 33 | 54 |
| 17 | 22 | 22 | 108 | 26 | 31 | 11 | 32 | 23 | 33 | 40 |
| 18 | 22 | 14 | 109 | 30 | 30 | 58 | 32 | 9 | 33 | 26 |
| 19 | 22 | 6 | 110 | 34 | 30 | 45 | 31 | 55 | 33 | 10 |
| 20 | 21 | 58 | 111 | 38 | 30 | 30 | 31 | 40 | 32 | 54 |
| 21 | 21 | 49 | 112 | 42 | 30 | 15 | 31 | 23 | 32 | 37 |
| 22 | 21 | 39 | 113 | 46 | 29 | 59 | 31 | 7 | 32 | 20 |
| 23 | 21 | 29 | 114 | 50 | 29 | 42 | 30 | 50 | 32 | 2 |
| 24 | 21 | 19 | 115 | 53 | 29 | 25 | 30 | 32 | 31 | 43 |
| 25 | 21 | 8 | 116 | 57 | 29 | 8 | 30 | 13 | 31 | 24 |
| 26 | 20 | 57 | 118 | 0 | 28 | 49 | 29 | 54 | 31 | 4 |
| 27 | 20 | 46 | 119 | 3 | 28 | 31 | 29 | 35 | 30 | 44 |
| 28 | 20 | 35 | 120 | 6 | 28 | 12 | 29 | 15 | 30 | 23 |
| 29 | 20 | 22 | 121 | 8 | 27 | 52 | 28 | 54 | 30 | 1 |
| 30 | 20 | 10 | 122 | 11 | 27 | 31 | 28 | 33 | 29 | 39 |

☞ For the R.A. of Capricornus add 180° to the same degree of Cancer. The Declin. and Asc. Diff. are the same for both.

| LEO AND AQUARIUS | | | | ASCENSIONAL DIFFERENCE | | | | |
|------------------|---------|-----|------------|------------------------|--------|-----------|-----------|----|
| Deg. | Declin. | | Rt. Ascen. | | London | Birming'm | Liverpool | |
| ° | ° | ' | ° | ' | ° | ' | ° | ' |
| 0 | 20 | 10 | 122 | 11 | 27 | 31 | 28 | 33 |
| 1 | 19 | 57 | 123 | 13 | 27 | 11 | 28 | 11 |
| 2 | 19 | 43 | 124 | 16 | 26 | 49 | 27 | 49 |
| 3 | 19 | 30 | 125 | 18 | 26 | 28 | 27 | 27 |
| 4 | 19 | 16 | 126 | 20 | 26 | 6 | 27 | 4 |
| 5 | 19 | - 1 | 127 | 21 | 25 | 43 | 26 | 40 |
| 6 | 18 | 47 | 128 | 23 | 25 | 21 | 26 | 16 |
| 7 | 18 | 32 | 129 | 24 | 24 | 57 | 25 | 52 |
| 8 | 18 | 17 | 130 | 25 | 24 | 34 | 25 | 28 |
| 9 | 18 | 1 | 131 | 26 | 24 | 10 | 25 | 3 |
| 10 | 17 | 45 | 132 | 27 | 23 | 46 | 24 | 37 |
| 11 | 17 | 29 | 133 | 27 | 23 | 21 | 24 | 12 |
| 12 | 17 | 12 | 134 | 28 | 22 | 56 | 23 | 46 |
| 13 | 16 | 55 | 135 | 28 | 22 | 31 | 23 | 20 |
| 14 | 16 | 38 | 136 | 28 | 22 | 5 | 22 | 53 |
| 15 | 16 | 21 | 137 | 28 | 21 | 40 | 22 | 26 |
| 16 | 16 | 3 | 138 | 28 | 21 | 14 | 21 | 59 |
| 17 | 15 | 45 | 139 | 27 | 20 | 47 | 21 | 32 |
| 18 | 15 | 27 | 140 | 27 | 20 | 21 | 21 | 5 |
| 19 | 15 | 8 | 141 | 26 | 19 | 54 | 20 | 37 |
| 20 | 14 | 49 | 142 | 25 | 19 | 27 | 20 | 9 |
| 21 | 14 | 30 | 143 | 23 | 19 | 0 | 19 | 41 |
| 22 | 14 | 11 | 144 | 22 | 18 | 33 | 19 | 12 |
| 23 | 13 | 51 | 145 | 21 | 18 | 5 | 18 | 44 |
| 24 | 13 | 32 | 146 | 19 | 17 | 38 | 18 | 15 |
| 25 | 13 | 12 | 147 | 17 | 17 | 10 | 17 | 46 |
| 26 | 12 | 51 | 148 | 15 | 16 | 42 | 17 | 17 |
| 27 | 12 | 31 | 149 | 13 | 16 | 14 | 16 | 48 |
| 28 | 12 | 10 | 150 | 11 | 15 | 45 | 16 | 19 |
| 29 | 11 | 50 | 151 | 8 | 15 | 17 | 15 | 49 |
| 30 | 11 | 29 | 152 | 5 | 14 | 48 | 15 | 19 |

 For the R.A. of Aquarius add 180° to the same degree of Leo. The Declin. and Asc. Diff. are the same for both.

| VIRGO AND PISCES | | | | ASCENSIONAL DIFFERENCE | | | | | | |
|------------------|---------|----|------------|------------------------|--------|----|-----------|----|-----------|----|
| Deg. | Declin. | | Rt. Ascen. | | London | | Birming'm | | Liverpool | |
| ° | ° | ' | ° | ' | ° | ' | ° | ' | ° | ' |
| 0 | 11 | 29 | 152 | 5 | 14 | 48 | 15 | 19 | 15 | 53 |
| 1 | 11 | 7 | 153 | 3 | 14 | 20 | 14 | 50 | 15 | 22 |
| 2 | 10 | 46 | 154 | 0 | 13 | 51 | 14 | 20 | 14 | 51 |
| 3 | 10 | 24 | 154 | 57 | 13 | 22 | 13 | 50 | 14 | 20 |
| 4 | 10 | 3 | 155 | 54 | 12 | 53 | 13 | 20 | 13 | 49 |
| 5 | 9 | 41 | 156 | 50 | 12 | 24 | 12 | 50 | 13 | 17 |
| 6 | 9 | 19 | 157 | 47 | 11 | 55 | 12 | 20 | 12 | 46 |
| 7 | 8 | 57 | 158 | 43 | 11 | 26 | 11 | 49 | 12 | 15 |
| 8 | 8 | 34 | 159 | 40 | 10 | 56 | 11 | 19 | 11 | 43 |
| 9 | 8 | 12 | 160 | 36 | 10 | 27 | 10 | 49 | 11 | 12 |
| 10 | 7 | 49 | 161 | 32 | 9 | 57 | 10 | 18 | 10 | 40 |
| 11 | 7 | 27 | 162 | 28 | 9 | 28 | 9 | 48 | 10 | 8 |
| 12 | 7 | 4 | 163 | 24 | 8 | 58 | 9 | 17 | 9 | 37 |
| 13 | 6 | 41 | 164 | 20 | 8 | 29 | 8 | 46 | 9 | 5 |
| 14 | 6 | 18 | 165 | 16 | 7 | 59 | 8 | 16 | 8 | 33 |
| 15 | 5 | 55 | 166 | 11 | 7 | 29 | 7 | 45 | 8 | 1 |
| 16 | 5 | 31 | 167 | 7 | 7 | 0 | 7 | 14 | 7 | 29 |
| 17 | 5 | 8 | 168 | 2 | 6 | 30 | 6 | 43 | 6 | 57 |
| 18 | 4 | 45 | 168 | 58 | 6 | 0 | 6 | 12 | 6 | 25 |
| 19 | 4 | 21 | 169 | 53 | 5 | 30 | 5 | 41 | 5 | 53 |
| 20 | 3 | 58 | 170 | 49 | 5 | 0 | 5 | 10 | 5 | 21 |
| 21 | 3 | 34 | 171 | 44 | 4 | 30 | 4 | 39 | 4 | 49 |
| 22 | 3 | 10 | 172 | 39 | 4 | 0 | 4 | 8 | 4 | 17 |
| 23 | 2 | 47 | 173 | 34 | 3 | 30 | 3 | 37 | 3 | 45 |
| 24 | 2 | 23 | 174 | 30 | 3 | 0 | 3 | 6 | 3 | 13 |
| 25 | 1 | 59 | 175 | 25 | 2 | 30 | 2 | 35 | 2 | 41 |
| 26 | 1 | 36 | 176 | 20 | 2 | 0 | 2 | 4 | 2 | 9 |
| 27 | 1 | 12 | 177 | 15 | 1 | 30 | 1 | 33 | 1 | 37 |
| 28 | 0 | 48 | 178 | 10 | 1 | 0 | 1 | 2 | 1 | 4 |
| 29 | 0 | 24 | 179 | 5 | 0 | 30 | 0 | 31 | 0 | 32 |
| 30 | 0 | 0 | 180 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

 For the R.A. of Pisces add 180° to the same degree of Virgo. The Declin. and Asc. Diff. are the same for both.

TERNARY PROPORTIONAL
LOGARITHMS

TERNARY PROPORTIONAL LOGARITHMS

| | 0° | 1° | 2° | 3° | 4° | 5° | 6° | 7° | 8° | 9° |
|----|----------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| 0 | Infinite | 2'25527 | 1'95424 | 1'77815 | 1'65321 | 1'55630 | 1'47712 | 1'41017 | 1'35218 | 1'30103 |
| 1 | 4'03342 | 2'24809 | 1'95064 | 1'77575 | 1'65141 | 1'55486 | 1'47592 | 1'40914 | 1'35128 | 1'30023 |
| 2 | 3'73239 | 2'24103 | 1'94706 | 1'77335 | 1'64961 | 1'55342 | 1'47472 | 1'40811 | 1'35038 | 1'29942 |
| 3 | 3'55030 | 2'23408 | 1'94352 | 1'77097 | 1'64782 | 1'55198 | 1'47352 | 1'40708 | 1'34948 | 1'29862 |
| 4 | 3'43136 | 2'22724 | 1'94000 | 1'76861 | 1'64603 | 1'55055 | 1'47232 | 1'40606 | 1'34858 | 1'29782 |
| 5 | 3'33445 | 2'22051 | 1'93651 | 1'76625 | 1'64426 | 1'54912 | 1'47113 | 1'40503 | 1'34768 | 1'29703 |
| 6 | 3'25527 | 2'21388 | 1'93305 | 1'76391 | 1'64249 | 1'54770 | 1'46994 | 1'40404 | 1'34679 | 1'29623 |
| 7 | 3'18833 | 2'20735 | 1'92962 | 1'76158 | 1'64073 | 1'54629 | 1'46876 | 1'40300 | 1'34589 | 1'29544 |
| 8 | 3'13033 | 2'20091 | 1'92621 | 1'75927 | 1'63897 | 1'54487 | 1'46758 | 1'40198 | 1'34500 | 1'29464 |
| 9 | 3'07918 | 2'19457 | 1'92283 | 1'75696 | 1'63722 | 1'54347 | 1'46640 | 1'40097 | 1'34411 | 1'29385 |
| 10 | 3'03342 | 2'18833 | 1'91948 | 1'75467 | 1'63548 | 1'54206 | 1'46522 | 1'39996 | 1'34323 | 1'29306 |
| 11 | 2'99203 | 2'18217 | 1'91615 | 1'75239 | 1'63375 | 1'54066 | 1'46404 | 1'39895 | 1'34234 | 1'29227 |
| 12 | 2'95424 | 2'17609 | 1'91285 | 1'75012 | 1'63202 | 1'53927 | 1'46288 | 1'39794 | 1'34146 | 1'29148 |
| 13 | 2'91948 | 2'17010 | 1'90957 | 1'74787 | 1'63030 | 1'53788 | 1'46171 | 1'39694 | 1'34058 | 1'29069 |
| 14 | 2'88730 | 2'16419 | 1'90632 | 1'74562 | 1'62859 | 1'53649 | 1'46055 | 1'39593 | 1'33970 | 1'28991 |
| 15 | 2'85733 | 2'15836 | 1'90309 | 1'74339 | 1'62688 | 1'53511 | 1'45938 | 1'39493 | 1'33882 | 1'28913 |
| 16 | 2'82930 | 2'15261 | 1'89988 | 1'74117 | 1'62518 | 1'53374 | 1'45824 | 1'39394 | 1'33794 | 1'28835 |
| 17 | 2'80297 | 2'14693 | 1'89670 | 1'73896 | 1'62349 | 1'53236 | 1'45708 | 1'39294 | 1'33707 | 1'28757 |
| 18 | 2'77815 | 2'14133 | 1'89354 | 1'73676 | 1'62180 | 1'53100 | 1'45593 | 1'39195 | 1'33619 | 1'28679 |
| 19 | 2'75467 | 2'13580 | 1'89041 | 1'73457 | 1'62012 | 1'52963 | 1'45478 | 1'39096 | 1'33532 | 1'28601 |
| 20 | 2'73239 | 2'13033 | 1'88730 | 1'73239 | 1'61845 | 1'52827 | 1'45364 | 1'38997 | 1'33445 | 1'28524 |
| 21 | 2'71120 | 2'12494 | 1'88420 | 1'73023 | 1'61678 | 1'52692 | 1'45250 | 1'38899 | 1'33359 | 1'28446 |
| 22 | 2'69100 | 2'11961 | 1'88114 | 1'72807 | 1'61512 | 1'52557 | 1'45136 | 1'38800 | 1'33272 | 1'28369 |
| 23 | 2'67170 | 2'11435 | 1'87809 | 1'72593 | 1'61347 | 1'52422 | 1'45022 | 1'38702 | 1'33186 | 1'28292 |
| 24 | 2'65321 | 2'10914 | 1'87506 | 1'72379 | 1'61182 | 1'52288 | 1'44909 | 1'38604 | 1'33099 | 1'28215 |
| 25 | 2'63548 | 2'10400 | 1'87206 | 1'72167 | 1'61018 | 1'52154 | 1'44796 | 1'38506 | 1'33013 | 1'28138 |
| 26 | 2'61845 | 2'09893 | 1'86907 | 1'71956 | 1'60854 | 1'52021 | 1'44684 | 1'38409 | 1'32927 | 1'28061 |
| 27 | 2'60206 | 2'09390 | 1'86611 | 1'71745 | 1'60691 | 1'51888 | 1'44571 | 1'38312 | 1'32842 | 1'27984 |
| 28 | 2'58627 | 2'08894 | 1'86316 | 1'71536 | 1'60529 | 1'51755 | 1'44459 | 1'38215 | 1'32756 | 1'27908 |
| 29 | 2'57103 | 2'08403 | 1'86024 | 1'71328 | 1'60367 | 1'51623 | 1'44347 | 1'38118 | 1'32671 | 1'27831 |
| 30 | 2'55630 | 2'07918 | 1'85733 | 1'71120 | 1'60206 | 1'51491 | 1'44236 | 1'38021 | 1'32585 | 1'27755 |
| 31 | 2'54206 | 2'07438 | 1'85445 | 1'70914 | 1'60045 | 1'51360 | 1'44125 | 1'37925 | 1'32500 | 1'27679 |
| 32 | 2'52827 | 2'06964 | 1'85158 | 1'70709 | 1'59885 | 1'51229 | 1'44014 | 1'37829 | 1'32415 | 1'27603 |
| 33 | 2'51491 | 2'06494 | 1'84873 | 1'70504 | 1'59726 | 1'51098 | 1'43903 | 1'37733 | 1'32331 | 1'27527 |
| 34 | 2'50194 | 2'06030 | 1'84590 | 1'70301 | 1'59567 | 1'50963 | 1'43793 | 1'37637 | 1'32246 | 1'27451 |
| 35 | 2'48936 | 2'05570 | 1'84309 | 1'70099 | 1'59409 | 1'50838 | 1'43683 | 1'37541 | 1'32162 | 1'27376 |
| 36 | 2'47712 | 2'05115 | 1'84030 | 1'69897 | 1'59251 | 1'50708 | 1'43573 | 1'37446 | 1'32077 | 1'27300 |
| 37 | 2'46522 | 2'04665 | 1'83752 | 1'69696 | 1'59094 | 1'50579 | 1'43463 | 1'37351 | 1'31993 | 1'27225 |
| 38 | 2'45364 | 2'04220 | 1'83477 | 1'69497 | 1'58938 | 1'50451 | 1'43354 | 1'37256 | 1'31909 | 1'27150 |
| 39 | 2'44236 | 2'03779 | 1'83203 | 1'69298 | 1'58782 | 1'50322 | 1'43245 | 1'37161 | 1'31826 | 1'27075 |
| 40 | 2'43136 | 2'03342 | 1'82930 | 1'69100 | 1'58627 | 1'50194 | 1'43136 | 1'37067 | 1'31742 | 1'27000 |
| 41 | 2'42064 | 2'02910 | 1'82660 | 1'68903 | 1'58472 | 1'50067 | 1'43028 | 1'36972 | 1'31659 | 1'26925 |
| 42 | 2'41017 | 2'02482 | 1'82391 | 1'68707 | 1'58317 | 1'49940 | 1'42920 | 1'36878 | 1'31575 | 1'26850 |
| 43 | 2'39996 | 2'02060 | 1'82124 | 1'68512 | 1'58164 | 1'49813 | 1'42812 | 1'36784 | 1'31492 | 1'26776 |
| 44 | 2'38997 | 2'01639 | 1'81858 | 1'68318 | 1'58011 | 1'49687 | 1'42704 | 1'36691 | 1'31409 | 1'26701 |
| 45 | 2'38021 | 2'01223 | 1'81594 | 1'68124 | 1'57858 | 1'49560 | 1'42597 | 1'36597 | 1'31326 | 1'26627 |
| 46 | 2'37067 | 2'00812 | 1'81332 | 1'67932 | 1'57706 | 1'49435 | 1'42490 | 1'36504 | 1'31244 | 1'26553 |
| 47 | 2'36133 | 2'00404 | 1'81071 | 1'67740 | 1'57554 | 1'49309 | 1'42383 | 1'36411 | 1'31161 | 1'26479 |
| 48 | 2'35218 | 2'00000 | 1'80811 | 1'67549 | 1'57403 | 1'49184 | 1'42276 | 1'36318 | 1'31079 | 1'26405 |
| 49 | 2'34323 | 1'99600 | 1'80554 | 1'67359 | 1'57253 | 1'49060 | 1'42170 | 1'36225 | 1'30997 | 1'26331 |
| 50 | 2'33445 | 1'99203 | 1'80297 | 1'67170 | 1'57103 | 1'48936 | 1'42064 | 1'36133 | 1'30915 | 1'26257 |
| 51 | 2'32585 | 1'98810 | 1'80043 | 1'66981 | 1'56953 | 1'48812 | 1'41958 | 1'36040 | 1'30833 | 1'26184 |
| 52 | 2'31742 | 1'98421 | 1'79790 | 1'66794 | 1'56804 | 1'48688 | 1'41853 | 1'35948 | 1'30751 | 1'26110 |
| 53 | 2'30915 | 1'98035 | 1'79538 | 1'66607 | 1'56656 | 1'48565 | 1'41747 | 1'35856 | 1'30670 | 1'26037 |
| 54 | 2'30103 | 1'97652 | 1'79287 | 1'66421 | 1'56508 | 1'48442 | 1'41642 | 1'35765 | 1'30588 | 1'25964 |
| 55 | 2'29306 | 1'97273 | 1'79039 | 1'66236 | 1'56360 | 1'48320 | 1'41538 | 1'35673 | 1'30507 | 1'25891 |
| 56 | 2'28524 | 1'96897 | 1'78791 | 1'66051 | 1'56213 | 1'48197 | 1'41433 | 1'35582 | 1'30426 | 1'25818 |
| 57 | 2'27755 | 1'96524 | 1'78545 | 1'65863 | 1'56067 | 1'48076 | 1'41329 | 1'35491 | 1'30345 | 1'25745 |
| 58 | 2'27000 | 1'96154 | 1'78300 | 1'65675 | 1'55921 | 1'47954 | 1'41225 | 1'35400 | 1'30264 | 1'25672 |
| 59 | 2'26257 | 1'95788 | 1'78057 | 1'65503 | 1'55775 | 1'47831 | 1'41121 | 1'35309 | 1'30183 | 1'25600 |
| 60 | 2'25527 | 1'95424 | 1'77815 | 1'65321 | 1'55630 | 1'47712 | 1'41017 | 1'35218 | 1'30103 | 1'25527 |

TERNARY PROPORTIONAL LOGARITHMS

| | 10° | 11° | 12° | 13° | 14° | 15° | 16° | 17° | 18° | 19° |
|----|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| 1 | 1°25527 | 1°21388 | 1°17609 | 1°14133 | 1°10914 | 1°07918 | 1°05115 | 1°02482 | 1°00000 | 0°97652 |
| 0 | 1°25453 | 1°21322 | 1°17549 | 1°14077 | 1°10863 | 1°07870 | 1°05070 | 1°02440 | 0°99960 | 0°97614 |
| 2 | 1°25383 | 1°21257 | 1°17489 | 1°14022 | 1°10811 | 1°07822 | 1°05025 | 1°02397 | 0°99920 | 0°97576 |
| 3 | 1°25311 | 1°21191 | 1°17429 | 1°13966 | 1°10760 | 1°07774 | 1°04980 | 1°02355 | 0°99880 | 0°97538 |
| 4 | 1°25239 | 1°21126 | 1°17369 | 1°13911 | 1°10708 | 1°07726 | 1°04935 | 1°02312 | 0°99839 | 0°97500 |
| 5 | 1°25167 | 1°21060 | 1°17309 | 1°13855 | 1°10657 | 1°07678 | 1°04890 | 1°02270 | 0°99799 | 0°97462 |
| 6 | 1°25095 | 1°20995 | 1°17249 | 1°13800 | 1°10605 | 1°07630 | 1°04845 | 1°02228 | 0°99759 | 0°97424 |
| 7 | 1°25024 | 1°20930 | 1°17189 | 1°13745 | 1°10554 | 1°07582 | 1°04800 | 1°02185 | 0°99719 | 0°97386 |
| 8 | 1°24952 | 1°20865 | 1°17129 | 1°13690 | 1°10503 | 1°07534 | 1°04755 | 1°02143 | 0°99679 | 0°97348 |
| 9 | 1°24881 | 1°20800 | 1°17070 | 1°13635 | 1°10452 | 1°07486 | 1°04710 | 1°02101 | 0°99640 | 0°97310 |
| 10 | 1°24809 | 1°20735 | 1°17010 | 1°13580 | 1°10400 | 1°07438 | 1°04665 | 1°02059 | 0°99600 | 0°97273 |
| 11 | 1°24738 | 1°20670 | 1°16951 | 1°13525 | 1°10349 | 1°07391 | 1°04620 | 1°02017 | 0°99560 | 0°97235 |
| 12 | 1°24667 | 1°20605 | 1°16891 | 1°13470 | 1°10298 | 1°07343 | 1°04576 | 1°01974 | 0°99520 | 0°97197 |
| 13 | 1°24596 | 1°20541 | 1°16832 | 1°13415 | 1°10247 | 1°07295 | 1°04531 | 1°01932 | 0°99480 | 0°97159 |
| 14 | 1°24526 | 1°20476 | 1°16773 | 1°13360 | 1°10197 | 1°07248 | 1°04486 | 1°01890 | 0°99441 | 0°97122 |
| 15 | 1°24455 | 1°20412 | 1°16714 | 1°13306 | 1°10146 | 1°07200 | 1°04442 | 1°01848 | 0°99401 | 0°97084 |
| 16 | 1°24384 | 1°20348 | 1°16655 | 1°13251 | 1°10095 | 1°07153 | 1°04397 | 1°01806 | 0°99361 | 0°97047 |
| 17 | 1°24314 | 1°20284 | 1°16596 | 1°13197 | 1°10044 | 1°07105 | 1°04353 | 1°01764 | 0°99322 | 0°97009 |
| 18 | 1°24244 | 1°20219 | 1°16537 | 1°13142 | 1°09994 | 1°07058 | 1°04308 | 1°01723 | 0°99282 | 0°96972 |
| 19 | 1°24173 | 1°20155 | 1°16478 | 1°13088 | 1°09943 | 1°07011 | 1°04264 | 1°01681 | 0°99243 | 0°96934 |
| 20 | 1°24103 | 1°20091 | 1°16419 | 1°13033 | 1°09893 | 1°06964 | 1°04220 | 1°01639 | 0°99203 | 0°96897 |
| 21 | 1°24033 | 1°20028 | 1°16361 | 1°12979 | 1°09842 | 1°06916 | 1°04175 | 1°01597 | 0°99164 | 0°96859 |
| 22 | 1°23963 | 1°19964 | 1°16302 | 1°12925 | 1°09792 | 1°06869 | 1°04131 | 1°01556 | 0°99124 | 0°96822 |
| 23 | 1°23894 | 1°19900 | 1°16243 | 1°12871 | 1°09741 | 1°06822 | 1°04087 | 1°01514 | 0°99085 | 0°96784 |
| 24 | 1°23824 | 1°19837 | 1°16185 | 1°12817 | 1°09691 | 1°06775 | 1°04043 | 1°01472 | 0°99045 | 0°96747 |
| 25 | 1°23754 | 1°19773 | 1°16127 | 1°12763 | 1°09641 | 1°06728 | 1°03999 | 1°01431 | 0°99006 | 0°96710 |
| 26 | 1°23685 | 1°19710 | 1°16068 | 1°12709 | 1°09591 | 1°06681 | 1°03955 | 1°01389 | 0°98967 | 0°96673 |
| 27 | 1°23616 | 1°19647 | 1°16010 | 1°12655 | 1°09540 | 1°06634 | 1°03911 | 1°01348 | 0°98928 | 0°96635 |
| 28 | 1°23546 | 1°19584 | 1°15952 | 1°12601 | 1°09490 | 1°06588 | 1°03867 | 1°01306 | 0°98888 | 0°96598 |
| 29 | 1°23477 | 1°19520 | 1°15894 | 1°12548 | 1°09440 | 1°06541 | 1°03823 | 1°01265 | 0°98849 | 0°96561 |
| 30 | 1°23408 | 1°19457 | 1°15836 | 1°12494 | 1°09390 | 1°06494 | 1°03779 | 1°01223 | 0°98810 | 0°96524 |
| 31 | 1°23339 | 1°19395 | 1°15778 | 1°12440 | 1°09341 | 1°06447 | 1°03735 | 1°01182 | 0°98771 | 0°96487 |
| 32 | 1°23271 | 1°19332 | 1°15721 | 1°12387 | 1°09291 | 1°06401 | 1°03691 | 1°01141 | 0°98732 | 0°96450 |
| 33 | 1°23202 | 1°19269 | 1°15663 | 1°12333 | 1°09241 | 1°06354 | 1°03647 | 1°01100 | 0°98693 | 0°96413 |
| 34 | 1°23133 | 1°19206 | 1°15605 | 1°12280 | 1°09192 | 1°06308 | 1°03604 | 1°01058 | 0°98654 | 0°96376 |
| 35 | 1°23065 | 1°19144 | 1°15548 | 1°12227 | 1°09142 | 1°06261 | 1°03560 | 1°01017 | 0°98615 | 0°96339 |
| 36 | 1°22997 | 1°19081 | 1°15490 | 1°12173 | 1°09092 | 1°06215 | 1°03516 | 1°00976 | 0°98576 | 0°96302 |
| 37 | 1°22928 | 1°19019 | 1°15433 | 1°12120 | 1°09042 | 1°06168 | 1°03473 | 1°00935 | 0°98537 | 0°96265 |
| 38 | 1°22860 | 1°18957 | 1°15375 | 1°12067 | 1°08993 | 1°06122 | 1°03429 | 1°00894 | 0°98498 | 0°96228 |
| 39 | 1°22792 | 1°18895 | 1°15318 | 1°12014 | 1°08943 | 1°06076 | 1°03386 | 1°00853 | 0°98459 | 0°96191 |
| 40 | 1°22724 | 1°18833 | 1°15261 | 1°11961 | 1°08894 | 1°06030 | 1°03342 | 1°00812 | 0°98421 | 0°96154 |
| 41 | 1°22657 | 1°18771 | 1°15204 | 1°11908 | 1°08845 | 1°05983 | 1°03299 | 1°00771 | 0°98382 | 0°96117 |
| 42 | 1°22589 | 1°18709 | 1°15147 | 1°11855 | 1°08796 | 1°05937 | 1°03256 | 1°00730 | 0°98343 | 0°96081 |
| 43 | 1°22521 | 1°18647 | 1°15090 | 1°11802 | 1°08746 | 1°05891 | 1°03212 | 1°00689 | 0°98304 | 0°96044 |
| 44 | 1°22454 | 1°18585 | 1°15033 | 1°11750 | 1°08697 | 1°05845 | 1°03169 | 1°00648 | 0°98266 | 0°96007 |
| 45 | 1°22386 | 1°18523 | 1°14976 | 1°11697 | 1°08648 | 1°05799 | 1°03126 | 1°00607 | 0°98227 | 0°95971 |
| 46 | 1°22319 | 1°18462 | 1°14919 | 1°11644 | 1°08599 | 1°05753 | 1°03083 | 1°00567 | 0°98189 | 0°95934 |
| 47 | 1°22252 | 1°18400 | 1°14863 | 1°11592 | 1°08550 | 1°05707 | 1°03039 | 1°00526 | 0°98150 | 0°95897 |
| 48 | 1°22185 | 1°18339 | 1°14806 | 1°11539 | 1°08501 | 1°05662 | 1°02996 | 1°00485 | 0°98111 | 0°95861 |
| 49 | 1°22118 | 1°18278 | 1°14750 | 1°11487 | 1°08452 | 1°05616 | 1°02953 | 1°00445 | 0°98073 | 0°95824 |
| 50 | 1°22051 | 1°18217 | 1°14693 | 1°11435 | 1°08403 | 1°05570 | 1°02910 | 1°00404 | 0°98035 | 0°95788 |
| 51 | 1°21984 | 1°18155 | 1°14637 | 1°11382 | 1°08355 | 1°05524 | 1°02867 | 1°00363 | 0°97996 | 0°95751 |
| 52 | 1°21918 | 1°18094 | 1°14581 | 1°11330 | 1°08306 | 1°05479 | 1°02824 | 1°00323 | 0°97958 | 0°95715 |
| 53 | 1°21851 | 1°18033 | 1°14524 | 1°11278 | 1°08257 | 1°05443 | 1°02781 | 1°00282 | 0°97919 | 0°95678 |
| 54 | 1°21785 | 1°17973 | 1°14468 | 1°11226 | 1°08209 | 1°05398 | 1°02739 | 1°00242 | 0°97881 | 0°95642 |
| 55 | 1°21718 | 1°17912 | 1°14412 | 1°11174 | 1°08160 | 1°05352 | 1°02696 | 1°00202 | 0°97843 | 0°95606 |
| 56 | 1°21652 | 1°17851 | 1°14356 | 1°11122 | 1°08112 | 1°05307 | 1°02653 | 1°00161 | 0°97805 | 0°95569 |
| 57 | 1°21586 | 1°17790 | 1°14300 | 1°11070 | 1°08063 | 1°05261 | 1°02610 | 1°00121 | 0°97766 | 0°95533 |
| 58 | 1°21520 | 1°17730 | 1°14244 | 1°11018 | 1°08015 | 1°05206 | 1°02568 | 1°00080 | 0°97728 | 0°95497 |
| 59 | 1°21454 | 1°17669 | 1°14188 | 1°10966 | 1°07966 | 1°05161 | 1°02525 | 1°00040 | 0°97690 | 0°95460 |
| 60 | 1°21388 | 1°17609 | 1°14133 | 1°10914 | 1°07918 | 1°05115 | 1°02482 | 1°00000 | 0°97652 | 0°95424 |

TERNARY PROPORTIONAL LOGARITHMS

| | 20° | 21° | 22° | 23° | 24° | 25° | 26° | 27° | 28° | 29° |
|----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 0 | 95424 | 93305 | 91285 | 89354 | 87506 | 85733 | 84030 | 82391 | 80811 | 79287 |
| 1 | 95388 | 93271 | 91252 | 89323 | 87476 | 85704 | 84002 | 82364 | 80786 | 79262 |
| 2 | 95352 | 93236 | 91219 | 89292 | 87446 | 85675 | 83974 | 82337 | 80760 | 79238 |
| 3 | 95316 | 93202 | 91186 | 89260 | 87416 | 85646 | 83946 | 82311 | 80734 | 79213 |
| 4 | 95280 | 93168 | 91154 | 89229 | 87386 | 85618 | 83919 | 82284 | 80708 | 79188 |
| 5 | 95244 | 93133 | 91121 | 89197 | 87356 | 85589 | 83891 | 82257 | 80682 | 79163 |
| 6 | 95208 | 93099 | 91088 | 89166 | 87326 | 85560 | 83863 | 82230 | 80657 | 79138 |
| 7 | 95172 | 93065 | 91055 | 89135 | 87296 | 85531 | 83835 | 82204 | 80631 | 79113 |
| 8 | 95136 | 93030 | 91023 | 89103 | 87266 | 85502 | 83808 | 82177 | 80605 | 79088 |
| 9 | 95100 | 92996 | 90990 | 89072 | 87236 | 85473 | 83780 | 82150 | 80579 | 79063 |
| 10 | 95064 | 92962 | 90957 | 89041 | 87206 | 85445 | 83752 | 82124 | 80554 | 79039 |
| 11 | 95028 | 92928 | 90925 | 89010 | 87176 | 85416 | 83725 | 82097 | 80528 | 79014 |
| 12 | 94992 | 92894 | 90892 | 88978 | 87146 | 85387 | 83697 | 82070 | 80502 | 78989 |
| 13 | 94956 | 92860 | 90859 | 88947 | 87116 | 85358 | 83670 | 82044 | 80477 | 78964 |
| 14 | 94921 | 92825 | 90827 | 88916 | 87086 | 85330 | 83642 | 82017 | 80451 | 78939 |
| 15 | 94885 | 92791 | 90794 | 88885 | 87056 | 85301 | 83614 | 81991 | 80425 | 78915 |
| 16 | 94849 | 92757 | 90762 | 88854 | 87026 | 85272 | 83587 | 81964 | 80400 | 78890 |
| 17 | 94813 | 92723 | 90729 | 88823 | 86996 | 85244 | 83559 | 81938 | 80374 | 78865 |
| 18 | 94778 | 92689 | 90697 | 88792 | 86967 | 85215 | 83532 | 81911 | 80349 | 78840 |
| 19 | 94742 | 92655 | 90664 | 88761 | 86937 | 85187 | 83504 | 81884 | 80323 | 78816 |
| 20 | 94706 | 92621 | 90632 | 88730 | 86907 | 85158 | 83477 | 81858 | 80297 | 78791 |
| 21 | 94671 | 92587 | 90599 | 88699 | 86877 | 85129 | 83449 | 81832 | 80272 | 78766 |
| 22 | 94635 | 92554 | 90567 | 88668 | 86848 | 85101 | 83422 | 81805 | 80246 | 78742 |
| 23 | 94600 | 92520 | 90535 | 88637 | 86818 | 85072 | 83394 | 81779 | 80221 | 78717 |
| 24 | 94564 | 92486 | 90502 | 88606 | 86788 | 85044 | 83367 | 81752 | 80195 | 78693 |
| 25 | 94529 | 92452 | 90470 | 88575 | 86759 | 85015 | 83339 | 81726 | 80170 | 78668 |
| 26 | 94493 | 92418 | 90438 | 88544 | 86729 | 84987 | 83312 | 81699 | 80144 | 78643 |
| 27 | 94458 | 92385 | 90406 | 88513 | 86699 | 84958 | 83285 | 81673 | 80119 | 78619 |
| 28 | 94423 | 92351 | 90373 | 88482 | 86670 | 84930 | 83257 | 81647 | 80094 | 78594 |
| 29 | 94387 | 92317 | 90341 | 88451 | 86640 | 84902 | 83230 | 81620 | 80068 | 78570 |
| 30 | 94352 | 92283 | 90309 | 88420 | 86611 | 84873 | 83203 | 81594 | 80043 | 78545 |
| 31 | 94317 | 92250 | 90277 | 88390 | 86581 | 84845 | 83175 | 81568 | 80017 | 78521 |
| 32 | 94281 | 92216 | 90245 | 88359 | 86552 | 84816 | 83148 | 81541 | 79992 | 78496 |
| 33 | 94246 | 92183 | 90213 | 88328 | 86522 | 84788 | 83121 | 81515 | 79967 | 78472 |
| 34 | 94211 | 92149 | 90181 | 88297 | 86493 | 84760 | 83094 | 81489 | 79941 | 78447 |
| 35 | 94176 | 92115 | 90148 | 88267 | 86463 | 84732 | 83066 | 81463 | 79916 | 78423 |
| 36 | 94141 | 92082 | 90116 | 88236 | 86434 | 84703 | 83039 | 81436 | 79891 | 78398 |
| 37 | 94105 | 92048 | 90084 | 88205 | 86404 | 84675 | 83012 | 81410 | 79865 | 78374 |
| 38 | 94070 | 92015 | 90052 | 88175 | 86375 | 84647 | 82985 | 81384 | 79840 | 78349 |
| 39 | 94035 | 91981 | 90020 | 88144 | 86346 | 84619 | 82958 | 81358 | 79815 | 78325 |
| 40 | 94000 | 91948 | 89988 | 88114 | 86316 | 84590 | 82930 | 81332 | 79790 | 78300 |
| 41 | 93965 | 91915 | 89957 | 88083 | 86287 | 84562 | 82903 | 81305 | 79764 | 78276 |
| 42 | 93930 | 91881 | 89925 | 88052 | 86258 | 84534 | 82876 | 81279 | 79739 | 78252 |
| 43 | 93895 | 91848 | 89893 | 88022 | 86228 | 84506 | 82849 | 81253 | 79714 | 78227 |
| 44 | 93860 | 91815 | 89861 | 87991 | 86199 | 84478 | 82822 | 81227 | 79689 | 78203 |
| 45 | 93825 | 91781 | 89829 | 87961 | 86170 | 84450 | 82795 | 81201 | 79663 | 78179 |
| 46 | 93791 | 91748 | 89797 | 87930 | 86140 | 84421 | 82768 | 81175 | 79638 | 78154 |
| 47 | 93756 | 91715 | 89766 | 87900 | 86111 | 84393 | 82741 | 81149 | 79613 | 78130 |
| 48 | 93721 | 91682 | 89734 | 87870 | 86082 | 84365 | 82714 | 81123 | 79588 | 78106 |
| 49 | 93686 | 91648 | 89702 | 87839 | 86053 | 84337 | 82687 | 81097 | 79563 | 78081 |
| 50 | 93651 | 91615 | 89670 | 87809 | 86024 | 84309 | 82660 | 81071 | 79538 | 78057 |
| 51 | 93617 | 91582 | 89639 | 87778 | 85995 | 84281 | 82633 | 81045 | 79513 | 78033 |
| 52 | 93582 | 91549 | 89607 | 87748 | 85965 | 84253 | 82606 | 81019 | 79488 | 78009 |
| 53 | 93547 | 91516 | 89575 | 87718 | 85936 | 84225 | 82579 | 80993 | 79463 | 77984 |
| 54 | 93513 | 91483 | 89544 | 87687 | 85907 | 84197 | 82552 | 80967 | 79437 | 77960 |
| 55 | 93478 | 91450 | 89512 | 87657 | 85878 | 84169 | 82525 | 80941 | 79412 | 77936 |
| 56 | 93443 | 91417 | 89481 | 87627 | 85849 | 84141 | 82498 | 80915 | 79387 | 77912 |
| 57 | 93409 | 91384 | 89449 | 87597 | 85820 | 84114 | 82471 | 80889 | 79362 | 77888 |
| 58 | 93374 | 91351 | 89417 | 87566 | 85791 | 84086 | 82445 | 80863 | 79337 | 77863 |
| 59 | 93340 | 91318 | 89386 | 87536 | 85762 | 84058 | 82418 | 80837 | 79312 | 77839 |
| 60 | 93305 | 91285 | 89354 | 87506 | 85733 | 84030 | 82391 | 80811 | 79287 | 77815 |

TERNARY PROPORTIONAL LOGARITHMS

| | 30° | 31° | 32° | 33° | 34° | 35° | 36° | 37° | 38° | 39° |
|----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 0 | 77815 | 76391 | 75012 | 73676 | 72379 | 71120 | 69897 | 68707 | 67549 | 66421 |
| 1 | 77791 | 76368 | 74990 | 73654 | 72358 | 71100 | 69877 | 68688 | 67530 | 66402 |
| 2 | 77767 | 76344 | 74967 | 73632 | 72337 | 71079 | 69857 | 68668 | 67511 | 66384 |
| 3 | 77743 | 76321 | 74944 | 73610 | 72316 | 71058 | 69837 | 68648 | 67492 | 66365 |
| 4 | 77719 | 76298 | 74922 | 73588 | 72294 | 71038 | 69817 | 68629 | 67473 | 66347 |
| 5 | 77695 | 76274 | 74899 | 73566 | 72273 | 71017 | 69797 | 68609 | 67454 | 66328 |
| 6 | 77671 | 76251 | 74877 | 73544 | 72252 | 70997 | 69777 | 68590 | 67435 | 66310 |
| 7 | 77647 | 76228 | 74854 | 73523 | 72231 | 70976 | 69756 | 68570 | 67416 | 66291 |
| 8 | 77623 | 76205 | 74832 | 73501 | 72209 | 70955 | 69736 | 68551 | 67397 | 66273 |
| 9 | 77599 | 76181 | 74809 | 73479 | 72188 | 70935 | 69716 | 68531 | 67378 | 66254 |
| 10 | 77575 | 76158 | 74787 | 73457 | 72167 | 70914 | 69696 | 68512 | 67359 | 66236 |
| 11 | 77551 | 76135 | 74764 | 73435 | 72146 | 70894 | 69676 | 68492 | 67340 | 66217 |
| 12 | 77527 | 76112 | 74742 | 73413 | 72125 | 70873 | 69656 | 68473 | 67321 | 66199 |
| 13 | 77503 | 76089 | 74719 | 73392 | 72103 | 70852 | 69636 | 68454 | 67302 | 66180 |
| 14 | 77479 | 76065 | 74697 | 73370 | 72082 | 70832 | 69616 | 68434 | 67283 | 66162 |
| 15 | 77455 | 76042 | 74674 | 73348 | 72061 | 70811 | 69596 | 68415 | 67264 | 66143 |
| 16 | 77431 | 76019 | 74652 | 73326 | 72040 | 70791 | 69576 | 68395 | 67245 | 66125 |
| 17 | 77407 | 75996 | 74629 | 73305 | 72019 | 70770 | 69557 | 68376 | 67226 | 66106 |
| 18 | 77383 | 75973 | 74607 | 73283 | 71998 | 70750 | 69537 | 68356 | 67207 | 66088 |
| 19 | 77359 | 75950 | 74585 | 73261 | 71977 | 70729 | 69517 | 68337 | 67188 | 66070 |
| 20 | 77335 | 75927 | 74562 | 73239 | 71956 | 70709 | 69497 | 68318 | 67170 | 66051 |
| 21 | 77311 | 75903 | 74540 | 73218 | 71935 | 70688 | 69477 | 68298 | 67151 | 66033 |
| 22 | 77288 | 75880 | 74517 | 73196 | 71914 | 70668 | 69457 | 68279 | 67132 | 66014 |
| 23 | 77264 | 75857 | 74495 | 73174 | 71892 | 70647 | 69437 | 68259 | 67113 | 65996 |
| 24 | 77240 | 75834 | 74473 | 73153 | 71871 | 70627 | 69417 | 68240 | 67094 | 65978 |
| 25 | 77216 | 75811 | 74450 | 73131 | 71850 | 70606 | 69397 | 68221 | 67075 | 65959 |
| 26 | 77192 | 75788 | 74428 | 73109 | 71829 | 70586 | 69377 | 68201 | 67056 | 65941 |
| 27 | 77169 | 75765 | 74406 | 73088 | 71808 | 70566 | 69358 | 68182 | 67038 | 65923 |
| 28 | 77145 | 75742 | 74383 | 73066 | 71787 | 70545 | 69338 | 68163 | 67019 | 65904 |
| 29 | 77121 | 75719 | 74361 | 73044 | 71766 | 70525 | 69318 | 68143 | 67000 | 65886 |
| 30 | 77097 | 75696 | 74339 | 73023 | 71745 | 70504 | 69298 | 68124 | 66981 | 65868 |
| 31 | 77074 | 75673 | 74317 | 73001 | 71724 | 70484 | 69278 | 68105 | 66962 | 65849 |
| 32 | 77050 | 75650 | 74294 | 72980 | 71703 | 70464 | 69258 | 68086 | 66944 | 65831 |
| 33 | 77026 | 75627 | 74272 | 72958 | 71682 | 70443 | 69239 | 68066 | 66925 | 65813 |
| 34 | 77002 | 75604 | 74250 | 72936 | 71662 | 70423 | 69219 | 68047 | 66906 | 65794 |
| 35 | 76979 | 75581 | 74228 | 72915 | 71641 | 70403 | 69199 | 68028 | 66887 | 65776 |
| 36 | 76955 | 75559 | 74205 | 72893 | 71620 | 70382 | 69179 | 68008 | 66869 | 65758 |
| 37 | 76931 | 75536 | 74183 | 72872 | 71599 | 70362 | 69159 | 67989 | 66850 | 65739 |
| 38 | 76908 | 75513 | 74161 | 72850 | 71578 | 70342 | 69140 | 67970 | 66831 | 65721 |
| 39 | 76884 | 75490 | 74139 | 72829 | 71557 | 70321 | 69120 | 67951 | 66812 | 65703 |
| 40 | 76861 | 75467 | 74117 | 72807 | 71536 | 70301 | 69100 | 67932 | 66794 | 65685 |
| 41 | 76837 | 75444 | 74095 | 72786 | 71515 | 70281 | 69080 | 67912 | 66775 | 65666 |
| 42 | 76813 | 75421 | 74072 | 72764 | 71494 | 70260 | 69061 | 67893 | 66756 | 65648 |
| 43 | 76790 | 75398 | 74050 | 72743 | 71473 | 70240 | 69041 | 67874 | 66737 | 65630 |
| 44 | 76766 | 75376 | 74028 | 72721 | 71453 | 70220 | 69021 | 67855 | 66719 | 65612 |
| 45 | 76743 | 75353 | 74006 | 72700 | 71432 | 70200 | 69002 | 67836 | 66700 | 65594 |
| 46 | 76719 | 75330 | 73984 | 72678 | 71411 | 70179 | 68982 | 67816 | 66681 | 65575 |
| 47 | 76696 | 75307 | 73962 | 72657 | 71390 | 70159 | 68962 | 67797 | 66663 | 65557 |
| 48 | 76672 | 75285 | 73940 | 72636 | 71369 | 70139 | 68942 | 67778 | 66644 | 65539 |
| 49 | 76649 | 75262 | 73918 | 72614 | 71349 | 70119 | 68923 | 67759 | 66625 | 65521 |
| 50 | 76625 | 75239 | 73896 | 72593 | 71328 | 70099 | 68903 | 67740 | 66607 | 65503 |
| 51 | 76602 | 75216 | 73874 | 72571 | 71307 | 70078 | 68884 | 67721 | 66588 | 65484 |
| 52 | 76578 | 75194 | 73852 | 72550 | 71286 | 70058 | 68864 | 67702 | 66570 | 65466 |
| 53 | 76555 | 75171 | 73830 | 72529 | 71265 | 70038 | 68844 | 67682 | 66551 | 65448 |
| 54 | 76531 | 75148 | 73808 | 72507 | 71245 | 70018 | 68825 | 67663 | 66532 | 65430 |
| 55 | 76508 | 75126 | 73786 | 72486 | 71224 | 69998 | 68805 | 67644 | 66514 | 65412 |
| 56 | 76485 | 75103 | 73764 | 72465 | 71203 | 69977 | 68785 | 67625 | 66495 | 65394 |
| 57 | 76461 | 75080 | 73742 | 72443 | 71183 | 69957 | 68766 | 67606 | 66477 | 65376 |
| 58 | 76438 | 75058 | 73720 | 72422 | 71162 | 69937 | 68746 | 67587 | 66458 | 65357 |
| 59 | 76414 | 75035 | 73698 | 72401 | 71141 | 69917 | 68727 | 67568 | 66439 | 65339 |
| 60 | 76391 | 75012 | 73676 | 72379 | 71120 | 69897 | 68707 | 67549 | 66421 | 65321 |

TERNARY PROPORTIONAL LOGARITHMS

| | 40° | 41° | 42° | 43° | 44° | 45° | 46° | 47° | 48° | 49° |
|----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 0 | 65321 | 64249 | 63202 | 62180 | 61182 | 60206 | 59251 | 58317 | 57403 | 56508 |
| 1 | 65303 | 64231 | 63185 | 62164 | 61166 | 60190 | 59236 | 58302 | 57388 | 56493 |
| 2 | 65285 | 64214 | 63168 | 62147 | 61149 | 60174 | 59220 | 58287 | 57373 | 56478 |
| 3 | 65267 | 64196 | 63151 | 62130 | 61133 | 60158 | 59204 | 58271 | 57358 | 56463 |
| 4 | 65249 | 64178 | 63133 | 62113 | 61116 | 60142 | 59189 | 58256 | 57343 | 56449 |
| 5 | 65231 | 64161 | 63116 | 62096 | 61100 | 60126 | 59173 | 58241 | 57328 | 56434 |
| 6 | 65213 | 64143 | 63099 | 62080 | 61083 | 60110 | 59157 | 58225 | 57313 | 56419 |
| 7 | 65195 | 64125 | 63082 | 62063 | 61067 | 60094 | 59141 | 58210 | 57298 | 56404 |
| 8 | 65177 | 64108 | 63065 | 62046 | 61051 | 60078 | 59126 | 58194 | 57283 | 56390 |
| 9 | 65159 | 64090 | 63047 | 62029 | 61034 | 60061 | 59110 | 58179 | 57268 | 56375 |
| 10 | 65141 | 64073 | 63030 | 62012 | 61018 | 60045 | 59094 | 58164 | 57253 | 56360 |
| 11 | 65123 | 64055 | 63013 | 61996 | 61001 | 60029 | 59079 | 58148 | 57238 | 56345 |
| 12 | 65105 | 64038 | 62996 | 61979 | 60985 | 60013 | 59063 | 58133 | 57223 | 56331 |
| 13 | 65087 | 64020 | 62979 | 61962 | 60969 | 59997 | 59047 | 58118 | 57208 | 56316 |
| 14 | 65069 | 64002 | 62962 | 61945 | 60952 | 59981 | 59032 | 58102 | 57193 | 56301 |
| 15 | 65051 | 63985 | 62945 | 61929 | 60936 | 59965 | 59016 | 58087 | 57178 | 56287 |
| 16 | 65033 | 63967 | 62927 | 61912 | 60920 | 59949 | 59000 | 58072 | 57163 | 56272 |
| 17 | 65015 | 63950 | 62910 | 61895 | 60903 | 59933 | 58985 | 58056 | 57148 | 56257 |
| 18 | 64997 | 63932 | 62893 | 61878 | 60887 | 59917 | 58969 | 58041 | 57133 | 56243 |
| 19 | 64979 | 63915 | 62876 | 61862 | 60871 | 59901 | 58954 | 58026 | 57118 | 56228 |
| 20 | 64961 | 63897 | 62859 | 61845 | 60854 | 59885 | 58938 | 58011 | 57103 | 56213 |
| 21 | 64943 | 63880 | 62842 | 61828 | 60838 | 59870 | 58922 | 57995 | 57088 | 56199 |
| 22 | 64925 | 63862 | 62825 | 61812 | 60822 | 59854 | 58907 | 57980 | 57073 | 56184 |
| 23 | 64907 | 63845 | 62808 | 61795 | 60805 | 59838 | 58891 | 57965 | 57058 | 56169 |
| 24 | 64889 | 63827 | 62791 | 61778 | 60789 | 59822 | 58875 | 57949 | 57043 | 56155 |
| 25 | 64871 | 63810 | 62774 | 61762 | 60773 | 59806 | 58860 | 57934 | 57028 | 56140 |
| 26 | 64853 | 63792 | 62757 | 61745 | 60756 | 59790 | 58844 | 57919 | 57013 | 56125 |
| 27 | 64835 | 63775 | 62739 | 61728 | 60740 | 59774 | 58829 | 57904 | 56998 | 56111 |
| 28 | 64818 | 63757 | 62722 | 61712 | 60724 | 59758 | 58813 | 57888 | 56983 | 56096 |
| 29 | 64800 | 63740 | 62705 | 61695 | 60708 | 59742 | 58798 | 57873 | 56968 | 56081 |
| 30 | 64782 | 63722 | 62688 | 61678 | 60691 | 59726 | 58782 | 57858 | 56953 | 56067 |
| 31 | 64764 | 63705 | 62671 | 61662 | 60675 | 59710 | 58766 | 57843 | 56938 | 56052 |
| 32 | 64746 | 63688 | 62654 | 61645 | 60659 | 59694 | 58751 | 57827 | 56923 | 56037 |
| 33 | 64728 | 63670 | 62637 | 61628 | 60642 | 59678 | 58735 | 57812 | 56908 | 56023 |
| 34 | 64710 | 63653 | 62620 | 61612 | 60626 | 59663 | 58720 | 57797 | 56893 | 56008 |
| 35 | 64692 | 63635 | 62603 | 61595 | 60610 | 59647 | 58704 | 57782 | 56879 | 55994 |
| 36 | 64675 | 63618 | 62586 | 61579 | 60594 | 59631 | 58689 | 57767 | 56864 | 55979 |
| 37 | 64657 | 63601 | 62569 | 61562 | 60578 | 59615 | 58673 | 57751 | 56849 | 55964 |
| 38 | 64639 | 63583 | 62552 | 61545 | 60561 | 59599 | 58658 | 57736 | 56834 | 55950 |
| 39 | 64621 | 63566 | 62535 | 61529 | 60545 | 59583 | 58642 | 57721 | 56819 | 55935 |
| 40 | 64603 | 63548 | 62518 | 61512 | 60529 | 59567 | 58627 | 57706 | 56804 | 55921 |
| 41 | 64586 | 63531 | 62501 | 61496 | 60513 | 59551 | 58611 | 57691 | 56789 | 55906 |
| 42 | 64568 | 63514 | 62484 | 61479 | 60496 | 59536 | 58596 | 57675 | 56774 | 55892 |
| 43 | 64550 | 63496 | 62468 | 61463 | 60480 | 59520 | 58580 | 57660 | 56759 | 55877 |
| 44 | 64532 | 63479 | 62451 | 61446 | 60464 | 59504 | 58565 | 57645 | 56745 | 55862 |
| 45 | 64514 | 63462 | 62434 | 61429 | 60448 | 59488 | 58549 | 57630 | 56730 | 55848 |
| 46 | 64497 | 63444 | 62417 | 61413 | 60432 | 59472 | 58534 | 57615 | 56715 | 55833 |
| 47 | 64479 | 63427 | 62400 | 61396 | 60416 | 59457 | 58518 | 57600 | 56700 | 55819 |
| 48 | 64461 | 63410 | 62383 | 61380 | 60399 | 59441 | 58503 | 57584 | 56685 | 55804 |
| 49 | 64443 | 63392 | 62366 | 61363 | 60383 | 59425 | 58487 | 57569 | 56670 | 55790 |
| 50 | 64426 | 63375 | 62349 | 61347 | 60367 | 59409 | 58472 | 57554 | 56656 | 55775 |
| 51 | 64408 | 63358 | 62332 | 61330 | 60351 | 59393 | 58456 | 57539 | 56641 | 55761 |
| 52 | 64390 | 63340 | 62315 | 61314 | 60335 | 59378 | 58441 | 57524 | 56626 | 55746 |
| 53 | 64373 | 63323 | 62298 | 61297 | 60319 | 59362 | 58425 | 57509 | 56611 | 55732 |
| 54 | 64355 | 63306 | 62282 | 61281 | 60303 | 59346 | 58410 | 57494 | 56596 | 55717 |
| 55 | 64337 | 63289 | 62265 | 61264 | 60286 | 59330 | 58395 | 57479 | 56582 | 55703 |
| 56 | 64320 | 63271 | 62248 | 61248 | 60270 | 59314 | 58379 | 57463 | 56567 | 55688 |
| 57 | 64302 | 63254 | 62231 | 61231 | 60254 | 59299 | 58364 | 57448 | 56552 | 55674 |
| 58 | 64284 | 63237 | 62214 | 61215 | 60238 | 59283 | 58348 | 57433 | 56537 | 55659 |
| 59 | 64267 | 63220 | 62197 | 61198 | 60222 | 59267 | 58333 | 57418 | 56522 | 55645 |
| 60 | 64249 | 63202 | 62180 | 61182 | 60206 | 59251 | 58317 | 57403 | 56508 | 55630 |

TERNARY PROPORTIONAL LOGARITHMS

| | 50° | 51° | 52° | 53° | 54° | 55° | 56° | 57° | 58° | 59° |
|----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 0 | 55630 | 54770 | 53927 | 53100 | 52288 | 51491 | 50708 | 49940 | 49184 | 48442 |
| 1 | 55616 | 54756 | 53913 | 53086 | 52274 | 51478 | 50696 | 49927 | 49172 | 48430 |
| 2 | 55601 | 54742 | 53899 | 53072 | 52261 | 51465 | 50683 | 49914 | 49159 | 48418 |
| 3 | 55587 | 54728 | 53885 | 53059 | 52248 | 51452 | 50670 | 49902 | 49147 | 48405 |
| 4 | 55572 | 54714 | 53871 | 53045 | 52234 | 51438 | 50657 | 49889 | 49135 | 48393 |
| 5 | 55558 | 54699 | 53857 | 53031 | 52221 | 51425 | 50644 | 49876 | 49122 | 48381 |
| 6 | 55543 | 54685 | 53843 | 53018 | 52208 | 51412 | 50631 | 49864 | 49110 | 48369 |
| 7 | 55529 | 54671 | 53830 | 53004 | 52194 | 51399 | 50618 | 49851 | 49097 | 48356 |
| 8 | 55515 | 54657 | 53816 | 52991 | 52181 | 51386 | 50605 | 49838 | 49085 | 48344 |
| 9 | 55500 | 54643 | 53802 | 52977 | 52167 | 51373 | 50592 | 49826 | 49072 | 48332 |
| 10 | 55486 | 54629 | 53788 | 52963 | 52154 | 51360 | 50579 | 49813 | 49060 | 48320 |
| 11 | 55471 | 54614 | 53774 | 52950 | 52141 | 51346 | 50566 | 49800 | 49047 | 48307 |
| 12 | 55457 | 54600 | 53760 | 52936 | 52127 | 51333 | 50554 | 49788 | 49035 | 48295 |
| 13 | 55442 | 54586 | 53746 | 52922 | 52114 | 51320 | 50541 | 49775 | 49023 | 48283 |
| 14 | 55428 | 54572 | 53732 | 52909 | 52101 | 51307 | 50528 | 49762 | 49010 | 48271 |
| 15 | 55414 | 54558 | 53719 | 52895 | 52087 | 51294 | 50515 | 49750 | 48998 | 48258 |
| 16 | 55399 | 54544 | 53705 | 52882 | 52074 | 51281 | 50502 | 49737 | 48985 | 48246 |
| 17 | 55385 | 54530 | 53691 | 52868 | 52061 | 51268 | 50489 | 49724 | 48973 | 48234 |
| 18 | 55370 | 54516 | 53677 | 52855 | 52047 | 51255 | 50476 | 49712 | 48960 | 48222 |
| 19 | 55356 | 54501 | 53663 | 52841 | 52034 | 51242 | 50464 | 49699 | 48948 | 48210 |
| 20 | 55342 | 54487 | 53649 | 52827 | 52021 | 51229 | 50451 | 49687 | 48936 | 48197 |
| 21 | 55327 | 54473 | 53636 | 52814 | 52007 | 51215 | 50438 | 49674 | 48923 | 48185 |
| 22 | 55313 | 54459 | 53622 | 52800 | 51994 | 51202 | 50425 | 49661 | 48911 | 48173 |
| 23 | 55299 | 54445 | 53608 | 52787 | 51981 | 51189 | 50412 | 49649 | 48898 | 48161 |
| 24 | 55284 | 54431 | 53594 | 52773 | 51967 | 51176 | 50399 | 49636 | 48886 | 48149 |
| 25 | 55270 | 54417 | 53580 | 52760 | 51954 | 51163 | 50387 | 49623 | 48874 | 48136 |
| 26 | 55255 | 54403 | 53567 | 52746 | 51941 | 51150 | 50374 | 49611 | 48861 | 48124 |
| 27 | 55241 | 54389 | 53553 | 52732 | 51927 | 51137 | 50361 | 49598 | 48849 | 48112 |
| 28 | 55227 | 54375 | 53539 | 52719 | 51914 | 51124 | 50348 | 49586 | 48836 | 48100 |
| 29 | 55212 | 54361 | 53525 | 52705 | 51901 | 51111 | 50335 | 49573 | 48824 | 48088 |
| 30 | 55198 | 54347 | 53511 | 52692 | 51888 | 51098 | 50322 | 49560 | 48812 | 48076 |
| 31 | 55184 | 54332 | 53498 | 52678 | 51874 | 51085 | 50310 | 49548 | 48799 | 48063 |
| 32 | 55169 | 54318 | 53484 | 52665 | 51861 | 51072 | 50297 | 49535 | 48787 | 48051 |
| 33 | 55155 | 54304 | 53470 | 52651 | 51848 | 51059 | 50284 | 49523 | 48775 | 48039 |
| 34 | 55141 | 54290 | 53456 | 52638 | 51835 | 51046 | 50271 | 49510 | 48762 | 48027 |
| 35 | 55127 | 54276 | 53442 | 52624 | 51821 | 51033 | 50258 | 49498 | 48750 | 48015 |
| 36 | 55112 | 54262 | 53429 | 52611 | 51808 | 51020 | 50246 | 49485 | 48737 | 48003 |
| 37 | 55098 | 54248 | 53415 | 52597 | 51795 | 51007 | 50233 | 49472 | 48725 | 47990 |
| 38 | 55084 | 54234 | 53401 | 52584 | 51781 | 50994 | 50220 | 49460 | 48713 | 47978 |
| 39 | 55069 | 54220 | 53387 | 52570 | 51768 | 50981 | 50207 | 49447 | 48700 | 47966 |
| 40 | 55055 | 54206 | 53374 | 52557 | 51755 | 50968 | 50194 | 49435 | 48688 | 47954 |
| 41 | 55041 | 54192 | 53360 | 52543 | 51742 | 50955 | 50182 | 49422 | 48676 | 47942 |
| 42 | 55026 | 54178 | 53346 | 52530 | 51729 | 50942 | 50169 | 49410 | 48663 | 47930 |
| 43 | 55012 | 54164 | 53332 | 52516 | 51715 | 50929 | 50156 | 49397 | 48651 | 47918 |
| 44 | 54998 | 54150 | 53319 | 52503 | 51702 | 50916 | 50143 | 49385 | 48639 | 47906 |
| 45 | 54984 | 54136 | 53305 | 52489 | 51689 | 50903 | 50131 | 49372 | 48626 | 47893 |
| 46 | 54969 | 54122 | 53291 | 52476 | 51676 | 50890 | 50118 | 49360 | 48614 | 47881 |
| 47 | 54955 | 54108 | 53278 | 52462 | 51662 | 50877 | 50105 | 49347 | 48602 | 47869 |
| 48 | 54941 | 54094 | 53264 | 52449 | 51649 | 50864 | 50092 | 49334 | 48590 | 47857 |
| 49 | 54927 | 54080 | 53250 | 52436 | 51636 | 50851 | 50080 | 49322 | 48577 | 47845 |
| 50 | 54912 | 54066 | 53236 | 52422 | 51623 | 50838 | 50067 | 49309 | 48565 | 47833 |
| 51 | 54898 | 54052 | 53223 | 52409 | 51610 | 50825 | 50054 | 49297 | 48553 | 47821 |
| 52 | 54884 | 54038 | 53209 | 52395 | 51596 | 50812 | 50041 | 49284 | 48540 | 47809 |
| 53 | 54870 | 54024 | 53195 | 52382 | 51583 | 50799 | 50029 | 49272 | 48528 | 47797 |
| 54 | 54855 | 54011 | 53182 | 52368 | 51570 | 50786 | 50016 | 49259 | 48516 | 47785 |
| 55 | 54841 | 53997 | 53168 | 52355 | 51557 | 50773 | 50003 | 49247 | 48503 | 47772 |
| 56 | 54827 | 53983 | 53154 | 52342 | 51544 | 50760 | 49991 | 49234 | 48491 | 47760 |
| 57 | 54813 | 53969 | 53141 | 52328 | 51530 | 50747 | 49978 | 49222 | 48479 | 47748 |
| 58 | 54799 | 53955 | 53127 | 52315 | 51517 | 50734 | 49965 | 49209 | 48467 | 47736 |
| 59 | 54784 | 53941 | 53113 | 52301 | 51504 | 50721 | 49952 | 49197 | 48454 | 47724 |
| 60 | 54770 | 53927 | 53100 | 52288 | 51491 | 50708 | 49940 | 49184 | 48442 | 47712 |

TERNARY PROPORTIONAL LOGARITHMS

| | 60° | 61° | 62° | 63° | 64° | 65° | 66° | 67° | 68° | 69° | 70° | 71° |
|----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 0 | 47712 | 46994 | 46288 | 45593 | 44909 | 44236 | 43573 | 42920 | 42276 | 41642 | 41017 | 40401 |
| 1 | 47700 | 46982 | 46276 | 45582 | 44898 | 44225 | 43562 | 42909 | 42266 | 41632 | 41007 | 40391 |
| 2 | 47688 | 46971 | 46265 | 45570 | 44887 | 44214 | 43551 | 42898 | 42255 | 41621 | 40997 | 40381 |
| 3 | 47676 | 46959 | 46253 | 45559 | 44875 | 44203 | 43540 | 42887 | 42244 | 41611 | 40986 | 40370 |
| 4 | 47664 | 46947 | 46241 | 45547 | 44864 | 44191 | 43529 | 42877 | 42234 | 41600 | 40976 | 40361 |
| 5 | 47652 | 46935 | 46230 | 45536 | 44853 | 44180 | 43518 | 42866 | 42223 | 41590 | 40966 | 40350 |
| 6 | 47640 | 46923 | 46218 | 45524 | 44841 | 44169 | 43507 | 42855 | 42213 | 41579 | 40955 | 40340 |
| 7 | 47628 | 46911 | 46206 | 45513 | 44830 | 44158 | 43496 | 42844 | 42202 | 41569 | 40945 | 40330 |
| 8 | 47616 | 46899 | 46195 | 45501 | 44819 | 44147 | 43485 | 42833 | 42191 | 41559 | 40935 | 40320 |
| 9 | 47604 | 46888 | 46183 | 45490 | 44808 | 44136 | 43474 | 42823 | 42181 | 41548 | 40924 | 40310 |
| 10 | 47592 | 46876 | 46171 | 45478 | 44796 | 44125 | 43463 | 42812 | 42170 | 41538 | 40914 | 40300 |
| 11 | 47580 | 46864 | 46160 | 45467 | 44785 | 44114 | 43452 | 42801 | 42159 | 41527 | 40904 | 40289 |
| 12 | 47568 | 46852 | 46148 | 45456 | 44774 | 44102 | 43441 | 42790 | 42149 | 41517 | 40894 | 40279 |
| 13 | 47556 | 46840 | 46137 | 45444 | 44762 | 44091 | 43431 | 42780 | 42138 | 41506 | 40883 | 40269 |
| 14 | 47544 | 46828 | 46125 | 45433 | 44751 | 44080 | 43420 | 42769 | 42128 | 41496 | 40873 | 40259 |
| 15 | 47532 | 46817 | 46113 | 45421 | 44740 | 44069 | 43409 | 42758 | 42117 | 41485 | 40863 | 40249 |
| 16 | 47520 | 46805 | 46102 | 45410 | 44729 | 44058 | 43398 | 42747 | 42106 | 41475 | 40852 | 40239 |
| 17 | 47508 | 46793 | 46090 | 45398 | 44717 | 44047 | 43387 | 42737 | 42096 | 41464 | 40842 | 40228 |
| 18 | 47496 | 46781 | 46078 | 45387 | 44706 | 44036 | 43376 | 42726 | 42085 | 41454 | 40832 | 40218 |
| 19 | 47484 | 46769 | 46067 | 45375 | 44695 | 44025 | 43365 | 42715 | 42075 | 41443 | 40821 | 40208 |
| 20 | 47472 | 46758 | 46055 | 45364 | 44684 | 44014 | 43354 | 42704 | 42064 | 41433 | 40811 | 40198 |
| 21 | 47460 | 46746 | 46044 | 45353 | 44672 | 44003 | 43343 | 42693 | 42053 | 41423 | 40801 | 40188 |
| 22 | 47448 | 46734 | 46032 | 45341 | 44661 | 43992 | 43332 | 42683 | 42043 | 41412 | 40791 | 40178 |
| 23 | 47436 | 46722 | 46020 | 45330 | 44650 | 43981 | 43321 | 42672 | 42032 | 41402 | 40780 | 40168 |
| 24 | 47424 | 46710 | 46009 | 45318 | 44639 | 43969 | 43310 | 42661 | 42022 | 41391 | 40770 | 40157 |
| 25 | 47412 | 46699 | 45997 | 45307 | 44627 | 43958 | 43300 | 42651 | 42011 | 41381 | 40760 | 40147 |
| 26 | 47400 | 46687 | 45986 | 45295 | 44616 | 43947 | 43289 | 42640 | 42000 | 41370 | 40749 | 40137 |
| 27 | 47388 | 46675 | 45974 | 45284 | 44605 | 43936 | 43278 | 42629 | 41990 | 41360 | 40739 | 40127 |
| 28 | 47376 | 46663 | 45962 | 45273 | 44594 | 43925 | 43267 | 42618 | 41979 | 41350 | 40729 | 40117 |
| 29 | 47364 | 46652 | 45951 | 45261 | 44583 | 43914 | 43256 | 42608 | 41969 | 41339 | 40719 | 40107 |
| 30 | 47352 | 46640 | 45939 | 45250 | 44571 | 43903 | 43245 | 42597 | 41958 | 41329 | 40708 | 40097 |
| 31 | 47340 | 46628 | 45928 | 45238 | 44560 | 43892 | 43234 | 42586 | 41948 | 41318 | 40699 | 40087 |
| 32 | 47328 | 46616 | 45916 | 45227 | 44549 | 43881 | 43223 | 42575 | 41937 | 41308 | 40688 | 40076 |
| 33 | 47316 | 46604 | 45905 | 45216 | 44538 | 43870 | 43212 | 42565 | 41927 | 41298 | 40678 | 40066 |
| 34 | 47304 | 46593 | 45893 | 45204 | 44526 | 43859 | 43202 | 42554 | 41916 | 41287 | 40667 | 40056 |
| 35 | 47292 | 46581 | 45881 | 45193 | 44515 | 43848 | 43191 | 42543 | 41905 | 41277 | 40657 | 40046 |
| 36 | 47280 | 46569 | 45870 | 45182 | 44504 | 43837 | 43180 | 42533 | 41895 | 41266 | 40647 | 40036 |
| 37 | 47268 | 46557 | 45858 | 45170 | 44493 | 43826 | 43169 | 42522 | 41884 | 41256 | 40637 | 40026 |
| 38 | 47256 | 46546 | 45847 | 45159 | 44482 | 43815 | 43158 | 42511 | 41874 | 41246 | 40626 | 40016 |
| 39 | 47244 | 46534 | 45835 | 45147 | 44470 | 43804 | 43147 | 42500 | 41863 | 41235 | 40616 | 40006 |
| 40 | 47232 | 46522 | 45824 | 45136 | 44459 | 43793 | 43136 | 42490 | 41853 | 41225 | 40606 | 39996 |
| 41 | 47220 | 46510 | 45812 | 45125 | 44448 | 43782 | 43126 | 42479 | 41842 | 41214 | 40596 | 39985 |
| 42 | 47208 | 46499 | 45800 | 45113 | 44437 | 43771 | 43115 | 42468 | 41832 | 41204 | 40585 | 39975 |
| 43 | 47196 | 46487 | 45789 | 45102 | 44426 | 43760 | 43104 | 42458 | 41821 | 41194 | 40575 | 39965 |
| 44 | 47185 | 46475 | 45777 | 45091 | 44414 | 43749 | 43093 | 42447 | 41811 | 41183 | 40565 | 39955 |
| 45 | 47173 | 46464 | 45766 | 45079 | 44403 | 43738 | 43082 | 42436 | 41800 | 41173 | 40555 | 39945 |
| 46 | 47161 | 46452 | 45754 | 45068 | 44392 | 43727 | 43071 | 42426 | 41789 | 41162 | 40544 | 39935 |
| 47 | 47149 | 46440 | 45743 | 45057 | 44381 | 43716 | 43060 | 42415 | 41779 | 41152 | 40534 | 39925 |
| 48 | 47137 | 46428 | 45731 | 45045 | 44370 | 43705 | 43050 | 42404 | 41768 | 41142 | 40524 | 39915 |
| 49 | 47125 | 46417 | 45720 | 45034 | 44359 | 43694 | 43039 | 42394 | 41758 | 41131 | 40514 | 39905 |
| 50 | 47113 | 46405 | 45708 | 45022 | 44347 | 43683 | 43028 | 42383 | 41747 | 41121 | 40503 | 39895 |
| 51 | 47101 | 46393 | 45697 | 45011 | 44336 | 43672 | 43017 | 42372 | 41737 | 41111 | 40493 | 39885 |
| 52 | 47089 | 46382 | 45685 | 45000 | 44325 | 43661 | 43006 | 42362 | 41726 | 41100 | 40483 | 39874 |
| 53 | 47077 | 46370 | 45674 | 44988 | 44314 | 43650 | 42995 | 42351 | 41716 | 41090 | 40473 | 39864 |
| 54 | 47066 | 46358 | 45662 | 44977 | 44303 | 43639 | 42985 | 42340 | 41705 | 41080 | 40463 | 39854 |
| 55 | 47054 | 46346 | 45651 | 44966 | 44292 | 43628 | 42974 | 42330 | 41695 | 41069 | 40452 | 39844 |
| 56 | 47042 | 46335 | 45639 | 44955 | 44280 | 43617 | 42963 | 42319 | 41684 | 41059 | 40442 | 39834 |
| 57 | 47030 | 46323 | 45628 | 44943 | 44269 | 43606 | 42952 | 42308 | 41674 | 41048 | 40432 | 39824 |
| 58 | 47018 | 46311 | 45616 | 44932 | 44258 | 43595 | 42941 | 42298 | 41663 | 41038 | 40422 | 39814 |
| 59 | 47006 | 46300 | 45605 | 44921 | 44247 | 43584 | 42931 | 42287 | 41653 | 41028 | 40412 | 39804 |
| 60 | 46994 | 46288 | 45593 | 44909 | 44236 | 43573 | 42920 | 42276 | 41642 | 41017 | 40401 | 39794 |

TERNARY PROPORTIONAL LOGARITHMS

| | 72° | 73° | 74° | 75° | 76° | 77° | 78° | 79° | 80° | 81° | 82° | 83° |
|----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1 | 39794 | 39195 | 38604 | 38021 | 37446 | 36878 | 36318 | 35765 | 35218 | 34679 | 34146 | 33619 |
| 2 | 39784 | 39185 | 38594 | 38011 | 37436 | 36869 | 36309 | 35755 | 35209 | 34670 | 34137 | 33611 |
| 3 | 39774 | 39175 | 38585 | 38002 | 37427 | 36859 | 36299 | 35746 | 35200 | 34661 | 34128 | 33602 |
| 4 | 39764 | 39165 | 38575 | 37992 | 37417 | 36850 | 36290 | 35737 | 35191 | 34652 | 34119 | 33593 |
| 5 | 39754 | 39155 | 38565 | 37983 | 37408 | 36841 | 36281 | 35728 | 35182 | 34643 | 34110 | 33585 |
| 6 | 39744 | 39145 | 38555 | 37973 | 37398 | 36831 | 36271 | 35719 | 35173 | 34634 | 34102 | 33576 |
| 7 | 39734 | 39136 | 38545 | 37963 | 37389 | 36822 | 36262 | 35710 | 35164 | 34625 | 34093 | 33567 |
| 8 | 39724 | 39126 | 38536 | 37954 | 37379 | 36812 | 36253 | 35700 | 35155 | 34616 | 34084 | 33558 |
| 9 | 39714 | 39116 | 38526 | 37944 | 37370 | 36803 | 36244 | 35691 | 35146 | 34607 | 34075 | 33550 |
| 10 | 39704 | 39106 | 38516 | 37934 | 37360 | 36794 | 36234 | 35682 | 35137 | 34598 | 34066 | 33541 |
| 11 | 39694 | 39096 | 38506 | 37925 | 37351 | 36784 | 36225 | 35673 | 35128 | 34589 | 34058 | 33532 |
| 12 | 39684 | 39086 | 38497 | 37915 | 37341 | 36775 | 36216 | 35664 | 35119 | 34581 | 34049 | 33524 |
| 13 | 39674 | 39076 | 38487 | 37905 | 37332 | 36766 | 36207 | 35655 | 35110 | 34572 | 34040 | 33515 |
| 14 | 39664 | 39066 | 38477 | 37896 | 37322 | 36756 | 36197 | 35646 | 35101 | 34563 | 34031 | 33506 |
| 15 | 39653 | 39056 | 38467 | 37886 | 37313 | 36747 | 36188 | 35636 | 35092 | 34554 | 34022 | 33498 |
| 16 | 39643 | 39046 | 38458 | 37877 | 37303 | 36737 | 36179 | 35627 | 35083 | 34545 | 34014 | 33489 |
| 17 | 39633 | 39037 | 38448 | 37867 | 37294 | 36728 | 36170 | 35618 | 35074 | 34536 | 34005 | 33480 |
| 18 | 39623 | 39027 | 38438 | 37857 | 37284 | 36719 | 36160 | 35609 | 35065 | 34527 | 33996 | 33471 |
| 19 | 39613 | 39017 | 38428 | 37848 | 37275 | 36709 | 36151 | 35600 | 35056 | 34518 | 33987 | 33463 |
| 20 | 39603 | 39007 | 38419 | 37838 | 37265 | 36700 | 36142 | 35591 | 35047 | 34509 | 33978 | 33454 |
| 21 | 39593 | 38997 | 38409 | 37829 | 37256 | 36691 | 36133 | 35582 | 35038 | 34500 | 33970 | 33445 |
| 22 | 39583 | 38987 | 38399 | 37819 | 37246 | 36681 | 36123 | 35573 | 35029 | 34491 | 33961 | 33437 |
| 23 | 39573 | 38977 | 38389 | 37809 | 37237 | 36672 | 36114 | 35563 | 35020 | 34483 | 33952 | 33428 |
| 24 | 39563 | 38968 | 38380 | 37800 | 37227 | 36663 | 36105 | 35554 | 35011 | 34474 | 33943 | 33419 |
| 25 | 39553 | 38958 | 38370 | 37790 | 37218 | 36653 | 36096 | 35545 | 35002 | 34465 | 33935 | 33411 |
| 26 | 39543 | 38948 | 38360 | 37781 | 37208 | 36644 | 36086 | 35536 | 34993 | 34456 | 33926 | 33402 |
| 27 | 39533 | 38938 | 38351 | 37771 | 37199 | 36634 | 36077 | 35527 | 34984 | 34447 | 33917 | 33393 |
| 28 | 39523 | 38928 | 38341 | 37761 | 37189 | 36625 | 36068 | 35518 | 34975 | 34438 | 33908 | 33385 |
| 29 | 39513 | 38918 | 38331 | 37752 | 37180 | 36616 | 36059 | 35509 | 34966 | 34429 | 33899 | 33376 |
| 30 | 39503 | 38908 | 38321 | 37742 | 37171 | 36606 | 36050 | 35500 | 34957 | 34420 | 33891 | 33367 |
| 31 | 39493 | 38899 | 38312 | 37733 | 37161 | 36597 | 36040 | 35491 | 34948 | 34411 | 33882 | 33359 |
| 32 | 39483 | 38889 | 38302 | 37723 | 37152 | 36588 | 36031 | 35481 | 34939 | 34403 | 33873 | 33350 |
| 33 | 39473 | 38879 | 38292 | 37713 | 37142 | 36578 | 36022 | 35472 | 34930 | 34394 | 33864 | 33341 |
| 34 | 39464 | 38869 | 38282 | 37704 | 37133 | 36569 | 36013 | 35463 | 34921 | 34385 | 33856 | 33333 |
| 35 | 39454 | 38859 | 38273 | 37694 | 37123 | 36560 | 36003 | 35454 | 34912 | 34376 | 33847 | 33324 |
| 36 | 39444 | 38849 | 38263 | 37685 | 37114 | 36550 | 35994 | 35445 | 34903 | 34367 | 33838 | 33315 |
| 37 | 39434 | 38839 | 38253 | 37675 | 37104 | 36541 | 35985 | 35436 | 34894 | 34358 | 33829 | 33307 |
| 38 | 39424 | 38830 | 38244 | 37665 | 37095 | 36532 | 35976 | 35427 | 34885 | 34349 | 33820 | 33298 |
| 39 | 39414 | 38820 | 38234 | 37656 | 37085 | 36522 | 35967 | 35418 | 34876 | 34340 | 33812 | 33289 |
| 40 | 39404 | 38810 | 38224 | 37646 | 37076 | 36513 | 35957 | 35409 | 34867 | 34332 | 33803 | 33281 |
| 41 | 39394 | 38800 | 38215 | 37637 | 37067 | 36504 | 35948 | 35400 | 34858 | 34323 | 33794 | 33272 |
| 42 | 39384 | 38790 | 38205 | 37627 | 37057 | 36494 | 35939 | 35391 | 34849 | 34314 | 33785 | 33263 |
| 43 | 39374 | 38781 | 38195 | 37618 | 37048 | 36485 | 35930 | 35381 | 34840 | 34305 | 33777 | 33255 |
| 44 | 39364 | 38771 | 38186 | 37608 | 37038 | 36476 | 35921 | 35372 | 34831 | 34296 | 33768 | 33246 |
| 45 | 39354 | 38761 | 38176 | 37599 | 37029 | 36467 | 35911 | 35363 | 34822 | 34287 | 33759 | 33237 |
| 46 | 39344 | 38751 | 38166 | 37589 | 37019 | 36457 | 35902 | 35354 | 34813 | 34278 | 33750 | 33229 |
| 47 | 39334 | 38741 | 38156 | 37579 | 37010 | 36448 | 35893 | 35345 | 34804 | 34270 | 33742 | 33220 |
| 48 | 39324 | 38731 | 38147 | 37570 | 37001 | 36439 | 35884 | 35336 | 34795 | 34261 | 33733 | 33211 |
| 49 | 39314 | 38722 | 38137 | 37560 | 36991 | 36429 | 35875 | 35327 | 34786 | 34252 | 33724 | 33203 |
| 50 | 39304 | 38712 | 38127 | 37551 | 36982 | 36420 | 35865 | 35318 | 34777 | 34243 | 33715 | 33194 |
| 51 | 39294 | 38702 | 38118 | 37541 | 36972 | 36411 | 35856 | 35309 | 34768 | 34234 | 33707 | 33186 |
| 52 | 39284 | 38692 | 38108 | 37532 | 36963 | 36401 | 35847 | 35300 | 34759 | 34225 | 33698 | 33177 |
| 53 | 39274 | 38682 | 38098 | 37522 | 36953 | 36392 | 35838 | 35291 | 34750 | 34217 | 33689 | 33168 |
| 54 | 39264 | 38673 | 38089 | 37513 | 36944 | 36383 | 35829 | 35282 | 34741 | 34208 | 33681 | 33160 |
| 55 | 39254 | 38663 | 38079 | 37503 | 36935 | 36374 | 35820 | 35273 | 34732 | 34199 | 33672 | 33151 |
| 56 | 39245 | 38653 | 38069 | 37494 | 36925 | 36364 | 35810 | 35264 | 34723 | 34190 | 33663 | 33142 |
| 57 | 39235 | 38643 | 38060 | 37484 | 36916 | 36355 | 35801 | 35254 | 34715 | 34182 | 33654 | 33134 |
| 58 | 39225 | 38633 | 38050 | 37474 | 36906 | 36346 | 35792 | 35245 | 34706 | 34172 | 33646 | 33125 |
| 59 | 39215 | 38624 | 38040 | 37465 | 36897 | 36336 | 35783 | 35236 | 34697 | 34164 | 33637 | 33117 |
| 60 | 39205 | 38614 | 38031 | 37455 | 36888 | 36327 | 35774 | 35227 | 34688 | 34155 | 33628 | 33108 |
| 61 | 39195 | 38604 | 38021 | 37446 | 36878 | 36318 | 35765 | 35218 | 34679 | 34146 | 33619 | 33099 |

TERNARY PROPORTIONAL LOGARITHMS

| | 84° | 85° | 86° | 87° | 88° | 89° | 90° | 91° | 92° | 93° | 94° | 95° |
|----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 0 | 33099 | 32585 | 32077 | 31575 | 31079 | 30588 | 30103 | 29623 | 29148 | 28679 | 28214 | 27755 |
| 1 | 33091 | 32577 | 32069 | 31567 | 31071 | 30580 | 30095 | 29615 | 29141 | 28671 | 28207 | 27747 |
| 2 | 33082 | 32568 | 32061 | 31559 | 31063 | 30572 | 30087 | 29607 | 29133 | 28663 | 28199 | 27740 |
| 3 | 33073 | 32560 | 32052 | 31550 | 31054 | 30564 | 30079 | 29599 | 29125 | 28656 | 28191 | 27732 |
| 4 | 33065 | 32551 | 32044 | 31542 | 31046 | 30556 | 30071 | 29591 | 29117 | 28648 | 28184 | 27724 |
| 5 | 33056 | 32543 | 32035 | 31534 | 31038 | 30548 | 30063 | 29583 | 29109 | 28640 | 28176 | 27717 |
| 6 | 33048 | 32534 | 32027 | 31525 | 31030 | 30539 | 30055 | 29575 | 29101 | 28632 | 28168 | 27709 |
| 7 | 33039 | 32526 | 32019 | 31517 | 31021 | 30531 | 30047 | 29567 | 29093 | 28625 | 28161 | 27702 |
| 8 | 33030 | 32517 | 32010 | 31509 | 31013 | 30523 | 30039 | 29560 | 29086 | 28617 | 28153 | 27694 |
| 9 | 33022 | 32509 | 32002 | 31501 | 31005 | 30515 | 30031 | 29552 | 29078 | 28609 | 28145 | 27686 |
| 10 | 33013 | 32500 | 31993 | 31492 | 30997 | 30507 | 30023 | 29544 | 29070 | 28601 | 28138 | 27679 |
| 11 | 33005 | 32492 | 31985 | 31484 | 30989 | 30499 | 30015 | 29536 | 29062 | 28593 | 28130 | 27671 |
| 12 | 32996 | 32483 | 31977 | 31476 | 30980 | 30491 | 30007 | 29528 | 29054 | 28586 | 28122 | 27664 |
| 13 | 32987 | 32475 | 31968 | 31467 | 30972 | 30483 | 29999 | 29520 | 29046 | 28578 | 28114 | 27656 |
| 14 | 32979 | 32466 | 31960 | 31459 | 30964 | 30475 | 29991 | 29512 | 29038 | 28570 | 28107 | 27648 |
| 15 | 32970 | 32458 | 31951 | 31451 | 30956 | 30466 | 29983 | 29504 | 29031 | 28562 | 28099 | 27641 |
| 16 | 32962 | 32449 | 31943 | 31442 | 30948 | 30458 | 29975 | 29496 | 29023 | 28555 | 28091 | 27633 |
| 17 | 32953 | 32441 | 31935 | 31434 | 30939 | 30450 | 29967 | 29488 | 29015 | 28547 | 28084 | 27626 |
| 18 | 32944 | 32432 | 31926 | 31426 | 30931 | 30442 | 29958 | 29480 | 29007 | 28539 | 28076 | 27618 |
| 19 | 32936 | 32424 | 31918 | 31418 | 30923 | 30434 | 29950 | 29472 | 28999 | 28531 | 28068 | 27610 |
| 20 | 32927 | 32415 | 31909 | 31409 | 30915 | 30426 | 29942 | 29464 | 28991 | 28524 | 28061 | 27603 |
| 21 | 32919 | 32407 | 31901 | 31401 | 30907 | 30418 | 29934 | 29456 | 28984 | 28516 | 28053 | 27595 |
| 22 | 32910 | 32398 | 31893 | 31393 | 30898 | 30410 | 29926 | 29448 | 28976 | 28508 | 28045 | 27588 |
| 23 | 32902 | 32390 | 31884 | 31384 | 30890 | 30402 | 29918 | 29441 | 28968 | 28500 | 28038 | 27580 |
| 24 | 32893 | 32381 | 31876 | 31376 | 30882 | 30393 | 29910 | 29433 | 28960 | 28493 | 28030 | 27572 |
| 25 | 32884 | 32373 | 31867 | 31368 | 30874 | 30385 | 29902 | 29425 | 28952 | 28485 | 28022 | 27565 |
| 26 | 32876 | 32365 | 31859 | 31360 | 30866 | 30377 | 29894 | 29417 | 28944 | 28477 | 28015 | 27557 |
| 27 | 32867 | 32356 | 31851 | 31351 | 30857 | 30369 | 29886 | 29409 | 28937 | 28469 | 28007 | 27550 |
| 28 | 32859 | 32348 | 31842 | 31343 | 30849 | 30361 | 29878 | 29401 | 28929 | 28462 | 27999 | 27542 |
| 29 | 32850 | 32339 | 31834 | 31335 | 30841 | 30353 | 29870 | 29393 | 28921 | 28454 | 27992 | 27534 |
| 30 | 32842 | 32331 | 31826 | 31326 | 30833 | 30345 | 29862 | 29385 | 28913 | 28446 | 27984 | 27527 |
| 31 | 32833 | 32322 | 31817 | 31318 | 30825 | 30337 | 29854 | 29377 | 28905 | 28438 | 27976 | 27519 |
| 32 | 32824 | 32314 | 31809 | 31310 | 30817 | 30329 | 29846 | 29369 | 28897 | 28431 | 27969 | 27512 |
| 33 | 32816 | 32305 | 31801 | 31302 | 30808 | 30321 | 29838 | 29361 | 28890 | 28423 | 27961 | 27504 |
| 34 | 32807 | 32297 | 31792 | 31293 | 30800 | 30313 | 29830 | 29354 | 28882 | 28415 | 27953 | 27497 |
| 35 | 32799 | 32288 | 31784 | 31285 | 30792 | 30305 | 29822 | 29346 | 28874 | 28407 | 27946 | 27489 |
| 36 | 32790 | 32280 | 31775 | 31277 | 30784 | 30296 | 29814 | 29338 | 28866 | 28400 | 27938 | 27481 |
| 37 | 32782 | 32271 | 31767 | 31269 | 30776 | 30288 | 29806 | 29330 | 28858 | 28392 | 27930 | 27474 |
| 38 | 32773 | 32263 | 31759 | 31260 | 30768 | 30280 | 29798 | 29322 | 28851 | 28384 | 27923 | 27466 |
| 39 | 32765 | 32255 | 31750 | 31252 | 30759 | 30272 | 29790 | 29314 | 28843 | 28376 | 27915 | 27459 |
| 40 | 32756 | 32246 | 31742 | 31244 | 30751 | 30264 | 29782 | 29306 | 28835 | 28369 | 27908 | 27451 |
| 41 | 32747 | 32238 | 31734 | 31236 | 30743 | 30256 | 29775 | 29298 | 28827 | 28361 | 27900 | 27444 |
| 42 | 32739 | 32229 | 31725 | 31227 | 30735 | 30248 | 29767 | 29290 | 28819 | 28353 | 27892 | 27436 |
| 43 | 32730 | 32221 | 31717 | 31219 | 30727 | 30240 | 29759 | 29282 | 28811 | 28346 | 27885 | 27429 |
| 44 | 32722 | 32212 | 31709 | 31211 | 30719 | 30232 | 29751 | 29275 | 28804 | 28338 | 27877 | 27421 |
| 45 | 32713 | 32204 | 31700 | 31203 | 30710 | 30224 | 29743 | 29267 | 28796 | 28330 | 27869 | 27413 |
| 46 | 32705 | 32195 | 31692 | 31194 | 30702 | 30216 | 29735 | 29259 | 28788 | 28322 | 27862 | 27406 |
| 47 | 32696 | 32187 | 31684 | 31186 | 30694 | 30208 | 29727 | 29251 | 28780 | 28315 | 27854 | 27398 |
| 48 | 32688 | 32179 | 31675 | 31178 | 30686 | 30200 | 29719 | 29243 | 28772 | 28307 | 27846 | 27391 |
| 49 | 32679 | 32170 | 31667 | 31170 | 30678 | 30192 | 29711 | 29235 | 28765 | 28299 | 27839 | 27383 |
| 50 | 32671 | 32162 | 31659 | 31161 | 30670 | 30183 | 29703 | 29227 | 28757 | 28292 | 27831 | 27376 |
| 51 | 32662 | 32153 | 31650 | 31153 | 30662 | 30175 | 29695 | 29219 | 28749 | 28284 | 27824 | 27368 |
| 52 | 32654 | 32145 | 31642 | 31145 | 30653 | 30167 | 29687 | 29211 | 28741 | 28276 | 27816 | 27360 |
| 53 | 32645 | 32136 | 31634 | 31137 | 30645 | 30159 | 29679 | 29204 | 28733 | 28268 | 27808 | 27353 |
| 54 | 32636 | 32128 | 31625 | 31128 | 30637 | 30151 | 29671 | 29196 | 28726 | 28261 | 27801 | 27345 |
| 55 | 32628 | 32120 | 31617 | 31120 | 30629 | 30143 | 29663 | 29188 | 28718 | 28253 | 27793 | 27338 |
| 56 | 32619 | 32111 | 31609 | 31112 | 30621 | 30135 | 29655 | 29180 | 28710 | 28245 | 27785 | 27330 |
| 57 | 32611 | 32103 | 31600 | 31104 | 30613 | 30127 | 29647 | 29172 | 28702 | 28238 | 27778 | 27323 |
| 58 | 32602 | 32094 | 31592 | 31095 | 30605 | 30119 | 29639 | 29164 | 28695 | 28230 | 27770 | 27315 |
| 59 | 32594 | 32086 | 31584 | 31087 | 30596 | 30111 | 29631 | 29156 | 28687 | 28222 | 27763 | 27308 |
| 60 | 32585 | 32077 | 31575 | 31079 | 30588 | 30103 | 29623 | 29148 | 28679 | 28214 | 27755 | 27300 |

TERNARY PROPORTIONAL LOGARITHMS

| | 96° | 97° | 98° | 99° | 100° | 101° | 102° | 103° | 104° | 105° | 106° | 107° |
|----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 0 | 27300 | 26850 | 26405 | 25964 | 25527 | 25095 | 24667 | 24244 | 23824 | 23408 | 22997 | 22589 |
| 1 | 27293 | 26843 | 26397 | 25956 | 25520 | 25088 | 24660 | 24237 | 23817 | 23401 | 22990 | 22582 |
| 2 | 27285 | 26835 | 26390 | 25949 | 25513 | 25081 | 24653 | 24229 | 23810 | 23395 | 22983 | 22575 |
| 3 | 27278 | 26828 | 26382 | 25942 | 25506 | 25074 | 24646 | 24222 | 23803 | 23388 | 22976 | 22569 |
| 4 | 27270 | 26820 | 26375 | 25934 | 25498 | 25066 | 24639 | 24215 | 23796 | 23381 | 22969 | 22562 |
| 5 | 27262 | 26813 | 26368 | 25927 | 25491 | 25059 | 24632 | 24208 | 23789 | 23374 | 22963 | 22555 |
| 6 | 27255 | 26805 | 26360 | 25920 | 25484 | 25052 | 24625 | 24201 | 23782 | 23367 | 22956 | 22548 |
| 7 | 27247 | 26798 | 26353 | 25913 | 25477 | 25045 | 24618 | 24194 | 23775 | 23360 | 22949 | 22542 |
| 8 | 27240 | 26790 | 26346 | 25905 | 25469 | 25038 | 24610 | 24187 | 23768 | 23353 | 22942 | 22535 |
| 9 | 27232 | 26783 | 26338 | 25898 | 25462 | 25031 | 24603 | 24180 | 23761 | 23346 | 22935 | 22528 |
| 10 | 27225 | 26776 | 26331 | 25891 | 25455 | 25024 | 24596 | 24173 | 23754 | 23339 | 22928 | 22521 |
| 11 | 27217 | 26768 | 26323 | 25883 | 25448 | 25016 | 24589 | 24166 | 23747 | 23332 | 22922 | 22515 |
| 12 | 27210 | 26761 | 26316 | 25876 | 25440 | 25009 | 24582 | 24159 | 23740 | 23326 | 22915 | 22508 |
| 13 | 27202 | 26753 | 26309 | 25869 | 25433 | 25002 | 24575 | 24152 | 23734 | 23319 | 22908 | 22501 |
| 14 | 27195 | 26746 | 26301 | 25861 | 25426 | 24995 | 24568 | 24145 | 23727 | 23312 | 22901 | 22494 |
| 15 | 27187 | 26738 | 26294 | 25854 | 25419 | 24988 | 24561 | 24138 | 23720 | 23305 | 22894 | 22488 |
| 16 | 27180 | 26731 | 26287 | 25847 | 25412 | 24981 | 24554 | 24131 | 23713 | 23298 | 22888 | 22481 |
| 17 | 27172 | 26723 | 26279 | 25840 | 25404 | 24973 | 24547 | 24124 | 23706 | 23291 | 22881 | 22474 |
| 18 | 27165 | 26716 | 26272 | 25832 | 25397 | 24966 | 24540 | 24117 | 23699 | 23284 | 22874 | 22467 |
| 19 | 27157 | 26709 | 26265 | 25825 | 25390 | 24959 | 24533 | 24110 | 23692 | 23277 | 22867 | 22460 |
| 20 | 27150 | 26701 | 26257 | 25818 | 25383 | 24952 | 24526 | 24103 | 23685 | 23271 | 22860 | 22454 |
| 21 | 27142 | 26694 | 26250 | 25810 | 25376 | 24945 | 24518 | 24096 | 23678 | 23264 | 22854 | 22447 |
| 22 | 27135 | 26686 | 26242 | 25803 | 25368 | 24938 | 24511 | 24089 | 23671 | 23257 | 22847 | 22440 |
| 23 | 27127 | 26679 | 26235 | 25796 | 25361 | 24931 | 24504 | 24082 | 23664 | 23250 | 22840 | 22434 |
| 24 | 27120 | 26671 | 26228 | 25789 | 25354 | 24923 | 24497 | 24075 | 23657 | 23243 | 22833 | 22427 |
| 25 | 27112 | 26664 | 26220 | 25781 | 25347 | 24916 | 24490 | 24068 | 23650 | 23236 | 22826 | 22420 |
| 26 | 27105 | 26656 | 26213 | 25774 | 25339 | 24909 | 24483 | 24061 | 23643 | 23229 | 22819 | 22413 |
| 27 | 27097 | 26649 | 26206 | 25767 | 25332 | 24902 | 24476 | 24054 | 23636 | 23222 | 22813 | 22407 |
| 28 | 27090 | 26642 | 26198 | 25759 | 25325 | 24895 | 24469 | 24047 | 23629 | 23216 | 22806 | 22400 |
| 29 | 27082 | 26634 | 26191 | 25752 | 25318 | 24888 | 24462 | 24040 | 23623 | 23209 | 22799 | 22393 |
| 30 | 27075 | 26627 | 26184 | 25745 | 25311 | 24881 | 24455 | 24033 | 23616 | 23202 | 22792 | 22386 |
| 31 | 27067 | 26619 | 26176 | 25738 | 25303 | 24874 | 24448 | 24026 | 23609 | 23195 | 22785 | 22380 |
| 32 | 27060 | 26612 | 26169 | 25730 | 25296 | 24866 | 24441 | 24019 | 23602 | 23188 | 22779 | 22373 |
| 33 | 27052 | 26605 | 26162 | 25723 | 25289 | 24859 | 24434 | 24012 | 23595 | 23181 | 22772 | 22366 |
| 34 | 27045 | 26597 | 26154 | 25716 | 25282 | 24852 | 24427 | 24005 | 23588 | 23175 | 22765 | 22359 |
| 35 | 27037 | 26590 | 26147 | 25709 | 25275 | 24845 | 24420 | 23998 | 23581 | 23168 | 22758 | 22353 |
| 36 | 27030 | 26582 | 26140 | 25701 | 25267 | 24838 | 24413 | 23991 | 23574 | 23161 | 22752 | 22346 |
| 37 | 27022 | 26575 | 26132 | 25694 | 25260 | 24831 | 24405 | 23984 | 23567 | 23154 | 22745 | 22339 |
| 38 | 27015 | 26567 | 26125 | 25687 | 25253 | 24824 | 24398 | 23977 | 23560 | 23147 | 22738 | 22333 |
| 39 | 27007 | 26560 | 26118 | 25680 | 25246 | 24817 | 24391 | 23970 | 23553 | 23140 | 22731 | 22326 |
| 40 | 27000 | 26553 | 26110 | 25672 | 25239 | 24809 | 24384 | 23963 | 23546 | 23133 | 22724 | 22319 |
| 41 | 26992 | 26545 | 26103 | 25665 | 25231 | 24802 | 24377 | 23956 | 23539 | 23127 | 22718 | 22312 |
| 42 | 26985 | 26538 | 26096 | 25658 | 25224 | 24795 | 24370 | 23949 | 23533 | 23120 | 22711 | 22306 |
| 43 | 26977 | 26530 | 26088 | 25650 | 25217 | 24788 | 24363 | 23942 | 23526 | 23113 | 22704 | 22299 |
| 44 | 26970 | 26523 | 26081 | 25643 | 25210 | 24781 | 24356 | 23935 | 23519 | 23106 | 22697 | 22292 |
| 45 | 26962 | 26516 | 26074 | 25636 | 25203 | 24774 | 24349 | 23928 | 23512 | 23099 | 22690 | 22286 |
| 46 | 26955 | 26508 | 26066 | 25629 | 25196 | 24767 | 24342 | 23921 | 23505 | 23092 | 22684 | 22279 |
| 47 | 26947 | 26501 | 26059 | 25621 | 25188 | 24760 | 24335 | 23914 | 23498 | 23086 | 22677 | 22272 |
| 48 | 26940 | 26493 | 26052 | 25614 | 25181 | 24752 | 24328 | 23908 | 23491 | 23079 | 22670 | 22265 |
| 49 | 26932 | 26486 | 26044 | 25607 | 25174 | 24745 | 24321 | 23901 | 23484 | 23072 | 22663 | 22259 |
| 50 | 26925 | 26479 | 26037 | 25600 | 25167 | 24738 | 24314 | 23894 | 23477 | 23065 | 22657 | 22252 |
| 51 | 26917 | 26471 | 26030 | 25592 | 25150 | 24731 | 24307 | 23887 | 23470 | 23058 | 22650 | 22245 |
| 52 | 26910 | 26464 | 26022 | 25585 | 25143 | 24724 | 24300 | 23880 | 23463 | 23051 | 22643 | 22239 |
| 53 | 26902 | 26456 | 26015 | 25578 | 25135 | 24717 | 24293 | 23873 | 23457 | 23044 | 22636 | 22232 |
| 54 | 26895 | 26449 | 26008 | 25571 | 25128 | 24710 | 24286 | 23866 | 23450 | 23038 | 22629 | 22225 |
| 55 | 26887 | 26442 | 26000 | 25563 | 25121 | 24703 | 24279 | 23859 | 23443 | 23031 | 22623 | 22218 |
| 56 | 26880 | 26434 | 25993 | 25556 | 25114 | 24696 | 24272 | 23852 | 23436 | 23024 | 22616 | 22212 |
| 57 | 26872 | 26427 | 25986 | 25549 | 25107 | 24689 | 24265 | 23845 | 23429 | 23017 | 22609 | 22205 |
| 58 | 26865 | 26419 | 25978 | 25542 | 25099 | 24681 | 24258 | 23838 | 23422 | 23010 | 22602 | 22198 |
| 59 | 26858 | 26412 | 25971 | 25534 | 25092 | 24674 | 24251 | 23831 | 23415 | 23004 | 22596 | 22192 |
| 60 | 26850 | 26405 | 25964 | 25527 | 25095 | 24667 | 24244 | 23824 | 23408 | 22997 | 22589 | 22185 |

TERNARY PROPORTIONAL LOGARITHMS

| | 108° | 109° | 110° | 111° | 112° | 113° | 114° | 115° | 116° | 117° | 118° | 119° |
|----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 0 | 22185 | 21785 | 21388 | 20995 | 20605 | 20219 | 19837 | 19457 | 19081 | 18709 | 18339 | 17973 |
| 1 | 22178 | 21778 | 21381 | 20988 | 20599 | 20213 | 19830 | 19451 | 19075 | 18702 | 18333 | 17966 |
| 2 | 22171 | 21771 | 21375 | 20982 | 20593 | 20207 | 19824 | 19445 | 19069 | 18696 | 18327 | 17960 |
| 3 | 22165 | 21765 | 21368 | 20975 | 20586 | 20200 | 19818 | 19439 | 19063 | 18690 | 18321 | 17954 |
| 4 | 22158 | 21758 | 21362 | 20969 | 20580 | 20194 | 19811 | 19432 | 19056 | 18684 | 18315 | 17948 |
| 5 | 22151 | 21751 | 21355 | 20962 | 20573 | 20187 | 19805 | 19426 | 19050 | 18678 | 18308 | 17942 |
| 6 | 22145 | 21745 | 21349 | 20956 | 20567 | 20181 | 19799 | 19420 | 19044 | 18672 | 18302 | 17936 |
| 7 | 22138 | 21738 | 21342 | 20949 | 20560 | 20175 | 19792 | 19413 | 19038 | 18665 | 18296 | 17930 |
| 8 | 22131 | 21732 | 21335 | 20943 | 20554 | 20168 | 19786 | 19407 | 19032 | 18659 | 18290 | 17924 |
| 9 | 22125 | 21725 | 21329 | 20936 | 20547 | 20162 | 19780 | 19401 | 19025 | 18653 | 18284 | 17918 |
| 10 | 22118 | 21718 | 21322 | 20930 | 20541 | 20155 | 19773 | 19395 | 19019 | 18647 | 18278 | 17912 |
| 11 | 22111 | 21712 | 21316 | 20923 | 20534 | 20149 | 19767 | 19388 | 19013 | 18641 | 18272 | 17906 |
| 12 | 22105 | 21705 | 21309 | 20917 | 20528 | 20143 | 19761 | 19382 | 19007 | 18634 | 18266 | 17900 |
| 13 | 22098 | 21698 | 21303 | 20910 | 20522 | 20136 | 19754 | 19376 | 19000 | 18628 | 18259 | 17894 |
| 14 | 22091 | 21692 | 21296 | 20904 | 20515 | 20130 | 19748 | 19369 | 18994 | 18622 | 18253 | 17887 |
| 15 | 22084 | 21685 | 21289 | 20897 | 20509 | 20123 | 19742 | 19363 | 18988 | 18616 | 18247 | 17881 |
| 16 | 22078 | 21678 | 21283 | 20891 | 20502 | 20117 | 19735 | 19357 | 18982 | 18610 | 18241 | 17875 |
| 17 | 22071 | 21672 | 21276 | 20884 | 20496 | 20111 | 19729 | 19351 | 18976 | 18604 | 18235 | 17869 |
| 18 | 22064 | 21665 | 21270 | 20878 | 20489 | 20104 | 19723 | 19344 | 18969 | 18597 | 18229 | 17863 |
| 19 | 22058 | 21659 | 21263 | 20871 | 20483 | 20098 | 19716 | 19338 | 18963 | 18591 | 18223 | 17857 |
| 20 | 22051 | 21652 | 21257 | 20865 | 20476 | 20091 | 19710 | 19332 | 18957 | 18585 | 18217 | 17851 |
| 21 | 22044 | 21645 | 21250 | 20858 | 20470 | 20085 | 19704 | 19325 | 18951 | 18579 | 18210 | 17845 |
| 22 | 22038 | 21639 | 21243 | 20852 | 20464 | 20079 | 19697 | 19319 | 18944 | 18573 | 18204 | 17839 |
| 23 | 22031 | 21632 | 21237 | 20845 | 20457 | 20072 | 19691 | 19313 | 18938 | 18567 | 18198 | 17833 |
| 24 | 22024 | 21626 | 21230 | 20839 | 20451 | 20066 | 19685 | 19307 | 18932 | 18560 | 18192 | 17827 |
| 25 | 22018 | 21619 | 21224 | 20832 | 20444 | 20060 | 19678 | 19300 | 18926 | 18554 | 18186 | 17821 |
| 26 | 22011 | 21612 | 21217 | 20826 | 20438 | 20053 | 19672 | 19294 | 18920 | 18548 | 18180 | 17815 |
| 27 | 22004 | 21606 | 21211 | 20819 | 20431 | 20047 | 19666 | 19288 | 18913 | 18542 | 18174 | 17809 |
| 28 | 21998 | 21599 | 21204 | 20813 | 20425 | 20040 | 19659 | 19282 | 18907 | 18536 | 18168 | 17803 |
| 29 | 21991 | 21592 | 21198 | 20806 | 20418 | 20034 | 19653 | 19275 | 18901 | 18530 | 18162 | 17797 |
| 30 | 21984 | 21586 | 21191 | 20800 | 20412 | 20028 | 19647 | 19269 | 18895 | 18523 | 18155 | 17790 |
| 31 | 21978 | 21579 | 21184 | 20793 | 20406 | 20021 | 19640 | 19263 | 18888 | 18517 | 18149 | 17784 |
| 32 | 21971 | 21573 | 21178 | 20787 | 20399 | 20015 | 19634 | 19257 | 18882 | 18511 | 18143 | 17778 |
| 33 | 21964 | 21566 | 21171 | 20780 | 20393 | 20009 | 19628 | 19250 | 18876 | 18505 | 18137 | 17772 |
| 34 | 21958 | 21559 | 21165 | 20774 | 20386 | 20002 | 19621 | 19244 | 18870 | 18499 | 18131 | 17766 |
| 35 | 21951 | 21553 | 21158 | 20767 | 20380 | 19996 | 19615 | 19238 | 18864 | 18493 | 18125 | 17760 |
| 36 | 21944 | 21546 | 21152 | 20761 | 20373 | 19989 | 19609 | 19231 | 18857 | 18487 | 18119 | 17754 |
| 37 | 21938 | 21540 | 21145 | 20754 | 20367 | 19983 | 19603 | 19225 | 18851 | 18480 | 18113 | 17748 |
| 38 | 21931 | 21533 | 21139 | 20748 | 20361 | 19977 | 19596 | 19219 | 18845 | 18474 | 18107 | 17742 |
| 39 | 21924 | 21526 | 21132 | 20741 | 20354 | 19970 | 19590 | 19213 | 18839 | 18468 | 18100 | 17736 |
| 40 | 21918 | 21520 | 21126 | 20735 | 20348 | 19964 | 19584 | 19206 | 18833 | 18462 | 18094 | 17730 |
| 41 | 21911 | 21513 | 21119 | 20728 | 20341 | 19958 | 19577 | 19200 | 18826 | 18456 | 18088 | 17724 |
| 42 | 21904 | 21507 | 21112 | 20722 | 20335 | 19951 | 19571 | 19194 | 18820 | 18450 | 18082 | 17718 |
| 43 | 21898 | 21500 | 21106 | 20715 | 20328 | 19945 | 19565 | 19188 | 18814 | 18443 | 18076 | 17712 |
| 44 | 21891 | 21493 | 21099 | 20709 | 20322 | 19938 | 19558 | 19181 | 18808 | 18437 | 18070 | 17706 |
| 45 | 21884 | 21487 | 21093 | 20702 | 20316 | 19932 | 19552 | 19175 | 18802 | 18431 | 18064 | 17700 |
| 46 | 21878 | 21480 | 21086 | 20696 | 20309 | 19926 | 19546 | 19169 | 18795 | 18425 | 18058 | 17694 |
| 47 | 21871 | 21474 | 21080 | 20690 | 20303 | 19919 | 19539 | 19163 | 18789 | 18419 | 18052 | 17688 |
| 48 | 21864 | 21467 | 21073 | 20683 | 20296 | 19913 | 19533 | 19156 | 18783 | 18413 | 18046 | 17682 |
| 49 | 21858 | 21460 | 21067 | 20676 | 20290 | 19907 | 19527 | 19150 | 18777 | 18407 | 18040 | 17676 |
| 50 | 21851 | 21454 | 21060 | 20670 | 20284 | 19900 | 19520 | 19144 | 18771 | 18400 | 18033 | 17669 |
| 51 | 21844 | 21447 | 21054 | 20664 | 20277 | 19894 | 19514 | 19138 | 18764 | 18394 | 18027 | 17663 |
| 52 | 21838 | 21441 | 21047 | 20657 | 20271 | 19888 | 19508 | 19131 | 18758 | 18388 | 18021 | 17657 |
| 53 | 21831 | 21434 | 21041 | 20651 | 20264 | 19881 | 19502 | 19125 | 18752 | 18382 | 18015 | 17651 |
| 54 | 21824 | 21427 | 21034 | 20644 | 20258 | 19875 | 19495 | 19119 | 18746 | 18376 | 18009 | 17645 |
| 55 | 21818 | 21421 | 21028 | 20638 | 20251 | 19869 | 19489 | 19113 | 18740 | 18370 | 18003 | 17639 |
| 56 | 21811 | 21414 | 21021 | 20631 | 20245 | 19862 | 19483 | 19106 | 18733 | 18364 | 17997 | 17633 |
| 57 | 21805 | 21408 | 21015 | 20625 | 20239 | 19856 | 19476 | 19100 | 18727 | 18357 | 17991 | 17627 |
| 58 | 21798 | 21401 | 21008 | 20618 | 20232 | 19849 | 19470 | 19094 | 18721 | 18351 | 17985 | 17621 |
| 59 | 21791 | 21395 | 21001 | 20612 | 20226 | 19843 | 19464 | 19088 | 18715 | 18345 | 17979 | 17615 |
| 60 | 21785 | 21388 | 20995 | 20605 | 20219 | 19837 | 19457 | 19081 | 18709 | 18339 | 17973 | 17609 |

TERNARY PROPORTIONAL LOGARITHMS

| | 120° | 121° | 122° | 123° | 124° | 125° | 126° | 127° | 128° | 129° | 130° | 131° |
|----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 0 | 17609 | 17249 | 16891 | 16537 | 16185 | 15836 | 15490 | 15147 | 14806 | 14468 | 14133 | 13800 |
| 1 | 17603 | 17243 | 16885 | 16531 | 16179 | 15830 | 15484 | 15141 | 14801 | 14463 | 14127 | 13795 |
| 2 | 17597 | 17237 | 16879 | 16525 | 16173 | 15825 | 15479 | 15135 | 14795 | 14457 | 14122 | 13789 |
| 3 | 17591 | 17231 | 16873 | 16519 | 16168 | 15819 | 15473 | 15130 | 14789 | 14451 | 14116 | 13784 |
| 4 | 17585 | 17225 | 16868 | 16513 | 16162 | 15813 | 15467 | 15124 | 14784 | 14446 | 14111 | 13778 |
| 5 | 17579 | 17219 | 16862 | 16507 | 16156 | 15807 | 15461 | 15118 | 14778 | 14440 | 14105 | 13773 |
| 6 | 17573 | 17213 | 16856 | 16501 | 16150 | 15802 | 15456 | 15113 | 14772 | 14435 | 14100 | 13767 |
| 7 | 17567 | 17207 | 16850 | 16496 | 16144 | 15796 | 15450 | 15107 | 14767 | 14429 | 14094 | 13761 |
| 8 | 17561 | 17201 | 16844 | 16490 | 16138 | 15790 | 15444 | 15101 | 14761 | 14423 | 14088 | 13756 |
| 9 | 17555 | 17195 | 16838 | 16484 | 16133 | 15784 | 15439 | 15096 | 14755 | 14418 | 14083 | 13750 |
| 10 | 17549 | 17189 | 16832 | 16478 | 16127 | 15778 | 15433 | 15090 | 14750 | 14412 | 14077 | 13745 |
| 11 | 17543 | 17183 | 16826 | 16472 | 16121 | 15773 | 15427 | 15084 | 14744 | 14407 | 14072 | 13739 |
| 12 | 17537 | 17177 | 16820 | 16466 | 16115 | 15767 | 15421 | 15079 | 14738 | 14401 | 14066 | 13734 |
| 13 | 17531 | 17171 | 16814 | 16460 | 16109 | 15761 | 15416 | 15073 | 14733 | 14395 | 14061 | 13728 |
| 14 | 17525 | 17165 | 16808 | 16454 | 16103 | 15755 | 15410 | 15067 | 14727 | 14390 | 14055 | 13723 |
| 15 | 17519 | 17159 | 16802 | 16449 | 16098 | 15749 | 15404 | 15061 | 14722 | 14384 | 14049 | 13717 |
| 16 | 17513 | 17153 | 16796 | 16443 | 16092 | 15744 | 15398 | 15056 | 14716 | 14379 | 14044 | 13712 |
| 17 | 17507 | 17147 | 16791 | 16437 | 16086 | 15738 | 15393 | 15050 | 14710 | 14373 | 14038 | 13706 |
| 18 | 17501 | 17141 | 16785 | 16431 | 16080 | 15732 | 15387 | 15044 | 14705 | 14367 | 14033 | 13701 |
| 19 | 17495 | 17135 | 16779 | 16425 | 16074 | 15726 | 15381 | 15039 | 14699 | 14362 | 14027 | 13695 |
| 20 | 17489 | 17129 | 16773 | 16419 | 16068 | 15721 | 15375 | 15033 | 14693 | 14356 | 14022 | 13690 |
| 21 | 17483 | 17123 | 16767 | 16413 | 16063 | 15715 | 15370 | 15027 | 14688 | 14351 | 14016 | 13684 |
| 22 | 17477 | 17117 | 16761 | 16407 | 16057 | 15709 | 15364 | 15022 | 14682 | 14345 | 14011 | 13679 |
| 23 | 17471 | 17111 | 16755 | 16402 | 16051 | 15703 | 15358 | 15016 | 14676 | 14339 | 14005 | 13673 |
| 24 | 17465 | 17105 | 16749 | 16396 | 16045 | 15697 | 15353 | 15010 | 14671 | 14334 | 14000 | 13668 |
| 25 | 17459 | 17099 | 16743 | 16390 | 16039 | 15692 | 15347 | 15005 | 14665 | 14328 | 13994 | 13662 |
| 26 | 17453 | 17093 | 16737 | 16384 | 16034 | 15686 | 15341 | 14999 | 14659 | 14323 | 13988 | 13657 |
| 27 | 17447 | 17087 | 16731 | 16378 | 16028 | 15680 | 15335 | 14993 | 14654 | 14317 | 13983 | 13651 |
| 28 | 17441 | 17082 | 16725 | 16372 | 16022 | 15674 | 15330 | 14988 | 14648 | 14311 | 13977 | 13646 |
| 29 | 17435 | 17076 | 16720 | 16366 | 16016 | 15669 | 15324 | 14982 | 14643 | 14306 | 13972 | 13640 |
| 30 | 17429 | 17070 | 16714 | 16361 | 16010 | 15663 | 15318 | 14976 | 14637 | 14300 | 13966 | 13635 |
| 31 | 17423 | 17064 | 16708 | 16355 | 16005 | 15657 | 15312 | 14971 | 14631 | 14295 | 13961 | 13629 |
| 32 | 17417 | 17058 | 16702 | 16349 | 15999 | 15651 | 15307 | 14965 | 14626 | 14289 | 13955 | 13624 |
| 33 | 17411 | 17052 | 16696 | 16343 | 15993 | 15646 | 15301 | 14959 | 14620 | 14284 | 13950 | 13618 |
| 34 | 17405 | 17046 | 16690 | 16337 | 15987 | 15640 | 15295 | 14954 | 14614 | 14278 | 13944 | 13613 |
| 35 | 17399 | 17040 | 16684 | 16331 | 15981 | 15634 | 15290 | 14948 | 14609 | 14272 | 13938 | 13607 |
| 36 | 17393 | 17034 | 16678 | 16325 | 15975 | 15628 | 15284 | 14942 | 14603 | 14267 | 13933 | 13602 |
| 37 | 17387 | 17028 | 16672 | 16320 | 15970 | 15623 | 15278 | 14937 | 14598 | 14261 | 13927 | 13596 |
| 38 | 17381 | 17022 | 16666 | 16314 | 15964 | 15617 | 15272 | 14931 | 14592 | 14256 | 13922 | 13591 |
| 39 | 17375 | 17016 | 16660 | 16308 | 15958 | 15611 | 15267 | 14925 | 14586 | 14250 | 13916 | 13585 |
| 40 | 17369 | 17010 | 16655 | 16302 | 15952 | 15605 | 15261 | 14919 | 14581 | 14244 | 13911 | 13580 |
| 41 | 17363 | 17004 | 16649 | 16296 | 15946 | 15599 | 15255 | 14914 | 14575 | 14239 | 13905 | 13574 |
| 42 | 17357 | 16998 | 16643 | 16290 | 15941 | 15594 | 15250 | 14908 | 14569 | 14233 | 13900 | 13569 |
| 43 | 17351 | 16992 | 16637 | 16284 | 15935 | 15588 | 15244 | 14902 | 14564 | 14228 | 13894 | 13563 |
| 44 | 17345 | 16986 | 16631 | 16279 | 15929 | 15582 | 15238 | 14897 | 14558 | 14222 | 13889 | 13558 |
| 45 | 17339 | 16980 | 16625 | 16273 | 15923 | 15576 | 15232 | 14891 | 14553 | 14217 | 13883 | 13552 |
| 46 | 17333 | 16974 | 16619 | 16267 | 15917 | 15571 | 15227 | 14886 | 14547 | 14211 | 13878 | 13547 |
| 47 | 17327 | 16968 | 16613 | 16261 | 15912 | 15565 | 15221 | 14880 | 14541 | 14205 | 13872 | 13541 |
| 48 | 17321 | 16963 | 16607 | 16255 | 15906 | 15559 | 15215 | 14874 | 14536 | 14200 | 13866 | 13536 |
| 49 | 17315 | 16957 | 16602 | 16249 | 15900 | 15553 | 15210 | 14869 | 14530 | 14194 | 13861 | 13530 |
| 50 | 17309 | 16951 | 16596 | 16243 | 15894 | 15548 | 15204 | 14863 | 14524 | 14189 | 13855 | 13525 |
| 51 | 17303 | 16945 | 16590 | 16238 | 15888 | 15542 | 15198 | 14857 | 14519 | 14183 | 13850 | 13519 |
| 52 | 17297 | 16939 | 16584 | 16232 | 15883 | 15536 | 15192 | 14852 | 14513 | 14177 | 13844 | 13514 |
| 53 | 17291 | 16933 | 16578 | 16226 | 15877 | 15530 | 15187 | 14846 | 14508 | 14172 | 13839 | 13508 |
| 54 | 17285 | 16927 | 16572 | 16220 | 15871 | 15525 | 15181 | 14840 | 14502 | 14166 | 13833 | 13503 |
| 55 | 17279 | 16921 | 16566 | 16214 | 15865 | 15519 | 15175 | 14835 | 14496 | 14161 | 13828 | 13497 |
| 56 | 17273 | 16915 | 16560 | 16208 | 15859 | 15513 | 15170 | 14829 | 14491 | 14155 | 13822 | 13492 |
| 57 | 17267 | 16909 | 16554 | 16203 | 15854 | 15507 | 15164 | 14823 | 14485 | 14150 | 13817 | 13486 |
| 58 | 17261 | 16903 | 16549 | 16197 | 15848 | 15502 | 15158 | 14818 | 14480 | 14144 | 13811 | 13481 |
| 59 | 17255 | 16897 | 16543 | 16191 | 15842 | 15496 | 15153 | 14812 | 14474 | 14138 | 13806 | 13475 |
| 60 | 17249 | 16891 | 16537 | 16185 | 15836 | 15490 | 15147 | 14806 | 14468 | 14133 | 13800 | 13470 |

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